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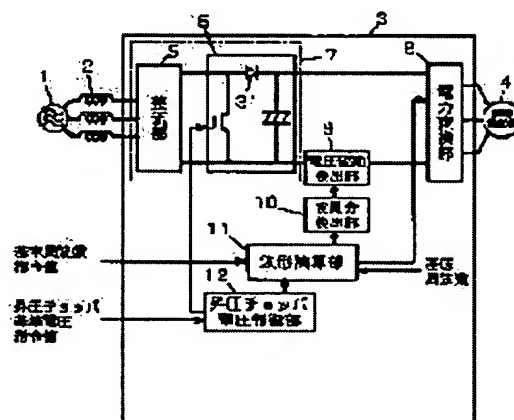
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(54) VIBRATION ALLEVIATING APPARATUS FOR AIR CONDITIONER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a vibration alleviating apparatus for an air conditioner for reducing vibrations, by a repetition of a regenerative state and a power state of an induction motor of the conditioner to be driven by an inverter.

SOLUTION: In an inverter 3, the variation in energy communicated between a DC power source 7 and a power converter 8 is detected as a voltage change by a voltage change detector 9. Only the change content of the voltage change is extracted from an AC component by a change content detector 10 is waveform shaped into a pulse. The pulse is outputted. A waveform calculator 11 calculates a regenerative frequency change amount and a power frequency change amount based on pulse widths of the pulses, corresponding to the regenerative state and the power state. Thus, a fundamental frequency command value for designating the frequency of the converter 8 and a boosted chopper reference voltage command value for designating an output voltage of a booster chopper 6 are corrected, based on the regenerative frequency change value when regenerating or based on the power frequency change amount at the time of the power state, thereby controlling the direction for suppressing vibration.



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CLAIMS

[Claim(s)]

[Claim 1] In the conditioner equipped with the inverter equipment which inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, Based on the pulse width and timing of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said pressure-up chopper section It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. Have the wave operation part which controls said power conversion section and said pressure-up chopper armature-voltage control section, amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition, and said wave operation part is set to said amendment. the predetermined base -- the oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to the range more than the output voltage of said rectification section corresponding to said fundamental-frequency command value after amendment exceeding a frequency.

[Claim 2] In the conditioner equipped with the inverter equipment which inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section

outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, The direct-current-voltage detecting element which detects the output voltage of said pressure-up chopper section, and the direct-current section voltage variation detecting element which detects said detected range of fluctuation of direct current voltage, The comparator which will output the coefficient of variation corresponding to an exceeded part if said range of fluctuation exceeds said direct-current section fluctuation allowed value for the range of fluctuation of said direct current voltage as compared with a predetermined direct-current section fluctuation allowed value, Based on the pulse width, the timing, and said coefficient of variation of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said pressure-up chopper section It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. Have the wave operation part which controls said power conversion section and said pressure-up chopper armature-voltage control section, amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition, and said wave operation part is set to said amendment. the predetermined base -- the oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to more than the output voltage of said rectification section to said fundamental-frequency command value after amendment exceeding a frequency.

[Claim 3] In the conditioner equipped with the inverter equipment which inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, Based on the pulse width and timing of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said alternating current It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. It has the wave operation part which controls said power conversion section while amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition. Said wave operation part said amendment -- setting -- the predetermined

base -- the oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to said fundamental-frequency command value after amendment exceeding a frequency on the addition electrical potential difference of the output voltage of said rectification section, and the amount of maximum regeneration voltage variation calculated by this time.

[Claim 4] In the conditioner equipped with the inverter equipment which inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, The direct-current-voltage detecting element which detects the output voltage of said pressure-up chopper section, and the direct-current section voltage variation detecting element which detects said detected range of fluctuation of direct current voltage, The comparator which will output the coefficient of variation corresponding to an exceeded part if said range of fluctuation exceeds said direct-current section fluctuation allowed value for the range of fluctuation of said direct current voltage as compared with a predetermined direct-current section fluctuation allowed value, Based on the pulse width, the timing, and said coefficient of variation of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said alternating current It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. It has the wave operation part which controls said power conversion section while amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition. Said wave operation part said amendment -- setting -- the predetermined base -- the oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to said fundamental-frequency command value after amendment exceeding a frequency on the addition electrical potential difference of the output voltage of said rectification section, and the amount of maximum regeneration voltage variation calculated by this time.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the oscillating relief equipment in the conditioner which drives a compressor with the inverter equipment of a PWM electrical-potential-difference form.

[0002]

[Description of the Prior Art] Hereafter, the conventional conditioner is explained. When V/F is fixed with the inverter equipment of a PWM electrical-potential-difference form and a compressor is driven, an unusual oscillation may occur according to operation frequency, the electric constant of an induction motor, the condition of a load, etc.

[0003] When this oscillation occurs, there is equipment indicated by JP,5-28078,B as a control means which controls that oscillation. He detects the polarity and period of the current which flows between the DC-power-supply section and the power conversion section, and is trying to prevent an oscillation with this means by amending a fundamental-frequency command value according to said polarity and the length of said period.

[0004]

[Problem(s) to be Solved by the Invention] With such an oscillating relief means of the conventional conditioner Since a judgment of power running or regeneration is made with the polarity of the current which flows between the DC-power-supply section and the power conversion section, In detection of only the section when the negative current is flowing when the oscillation has occurred in the situation which was made to drive the compressor of a conditioner and a certain amount of load has required In order to be unable to detect the criteria of fluctuation to accuracy but to perform oscillating relief control to it on the basis of this signal, when fluctuation of energy inclines and it is changing as shown in drawing 16 , When the criteria of energy fluctuation cannot hold to accuracy, the timing to which oscillating relief control is applied shifts, and the problem said that stability falls as a result occurs.

[0005] Moreover, although the non-contact current transformer is used as a detector of a current which flows between the DC-power-supply section and the power conversion section, said non-contact current transformer is comparatively expensive, and what it is hard to apply in respect of cost to a conditioner is the actual condition.

[0006] furthermore, with the conventional configuration, in order to adopt the full-wave-rectification method which used diode for the rectification section, the maximum electrical potential difference of the DC-power-supply section is determined with supply voltage -- having -- the base -- since an electrical potential difference was not able to be made to increase more than said maximum electrical potential difference when the oscillation has occurred in the field more than a frequency, oscillating relief control was impossible.

[0007] the case where this invention solves the above-mentioned technical problem, and the criteria of change of the energy between the DC-power-supply section and the power conversion section are partial -- also setting -- change of energy -- exact -- catching -- and the base -- it aims at offering the oscillating relief equipment of the conditioner which can demonstrate effectiveness also in the field more than a frequency.

[0008]

[Means for Solving the Problem] In the conditioner equipped with the inverter equipment which this invention concerning claim 1 inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, Based on the pulse width and timing of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said pressure-up chopper section It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. Have the wave operation part which controls said power conversion section and said pressure-up chopper armature-voltage control section, amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition, and said wave operation part is set to said amendment. the predetermined base -- it is oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to the range more than the output voltage of said rectification section corresponding to said fundamental-frequency command value after amendment exceeding a frequency.

[0009] By this invention, when the criteria of change of the energy delivered and received between the pressure-up chopper section and the power conversion section are partial, the changing point of transfer of energy can be caught exactly. moreover, the base predetermined in the operation frequency of an induction motor -- since the output voltage of the pressure-up chopper section is controllable also in the field beyond a frequency, the oscillation cheaply generated in the compressor of a conditioner over the output range whole region of inverter equipment can be made to mitigate moreover, the output voltage of said pressure-up chopper section -- said base -- only in the field more than a frequency, since it raises as required, the life of the capacitor for smooth with which said pressure-up chopper section is equipped is not affected, but it is made to what has high dependability.

[0010] In the conditioner equipped with the inverter equipment which this invention concerning claim 2 inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting

element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, The direct-current-voltage detecting element which detects the output voltage of said pressure-up chopper section, and the direct-current section voltage variation detecting element which detects said detected range of fluctuation of direct current voltage, The comparator which will output the coefficient of variation corresponding to an exceeded part if said range of fluctuation exceeds said direct-current section fluctuation allowed value for the range of fluctuation of said direct current voltage as compared with a predetermined direct-current section fluctuation allowed value, Based on the pulse width, the timing, and said coefficient of variation of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said pressure-up chopper section It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. Have the wave operation part which controls said power conversion section and said pressure-up chopper armature-voltage control section, amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition, and said wave operation part is set to said amendment. the predetermined base -- it is oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to more than the output voltage of said rectification section to said fundamental-frequency command value after amendment exceeding a frequency.

[0011] By this invention, when the criteria of change of the energy delivered and received between the pressure-up chopper section and the power conversion section are partial, the changing point of transfer of energy can be caught exactly. And the range of fluctuation of said output voltage supervises, and fluctuation of said output voltage is made small as a result by reflecting this range of fluctuation in control. furthermore, the base predetermined in the operation frequency of an induction motor -- since the output voltage of the pressure-up chopper section is controllable also in the field beyond a frequency, it can cross throughout the output range of inverter equipment, and the oscillation generated with a more sufficient precision in the compressor of a conditioner can be made to mitigate moreover, the output voltage of said pressure-up chopper section -- said base -- only in the field more than a frequency, since it raises as required, the life of the capacitor for smooth with which said pressure-up chopper section is equipped is not affected, but it is made to what has high dependability.

[0012] In the conditioner equipped with the inverter equipment which this invention concerning claim 3 inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, Based on the pulse width and timing of said pulse, the amount of regeneration voltage variation

corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said alternating current It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. It has the wave operation part which controls said power conversion section while amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition. Said wave operation part In said amendment the predetermined base -- it is oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to said fundamental-frequency command value after amendment exceeding a frequency on the addition electrical potential difference of the output voltage of said rectification section, and the amount of maximum regeneration voltage variation calculated by this time.

[0013] By this invention, when the criteria of change of the energy delivered and received between the pressure-up chopper section and the power conversion section are partial, the changing point of transfer of energy can be caught exactly. moreover, the base predetermined in the operation frequency of an induction motor, when only the amount of maximum regeneration voltage variation raises and controls the output voltage of the pressure-up chopper section in the field beyond a frequency The oscillation cheaply generated in the compressor of a conditioner over the output range whole region of inverter equipment can be made to mitigate, simplifying control of the pressure-up chopper armature-voltage control section. moreover, the output voltage of said pressure-up chopper section -- said base -- only in the field more than a frequency, since it raises as required, the life of the capacitor for smooth with which said pressure-up chopper section is equipped is not affected, but it is made to what has high dependability.

[0014] In the conditioner equipped with the inverter equipment which this invention concerning claim 4 inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, The direct-current-voltage detecting element which detects the output voltage of said pressure-up chopper section, and the direct-current section voltage variation detecting element which detects said detected range of fluctuation of direct current voltage, The comparator which will output the coefficient of variation corresponding to an exceeded part if said range of fluctuation exceeds said direct-current section fluctuation allowed value for the range of fluctuation of said direct current voltage as compared with a predetermined direct-current section fluctuation allowed value, Based on the pulse width, the timing, and said coefficient of variation of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said alternating current It is based on said amount of

regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. It has the wave operation part which controls said power conversion section while amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition. Said wave operation part In said amendment the predetermined base -- it is oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to said fundamental-frequency command value after amendment exceeding a frequency on the addition electrical potential difference of the output voltage of said rectification section, and the amount of maximum regeneration voltage variation calculated by this time.

[0015] By this invention, when the criteria of change of the energy delivered and received between the pressure-up chopper section and the power conversion section are partial, the changing point of transfer of energy can be caught exactly. And supervise the range of fluctuation of said output voltage, and fluctuation of said output voltage is made small as a result by reflecting this range of fluctuation in control. furthermore, the base predetermined in the operation frequency of an induction motor, when only the amount of maximum regeneration voltage variation raises and controls the output voltage of the pressure-up chopper section in the field beyond a frequency It can cross throughout the output range of inverter equipment, simplifying control of the pressure-up chopper armature-voltage control section, and the oscillation generated with a more sufficient precision in the compressor of a conditioner can be made to mitigate. moreover, the output voltage of said pressure-up chopper section -- said base -- only in the field more than a frequency, since it raises as required, the life of the capacitor for smooth with which said pressure-up chopper section is equipped is not affected, but it is made to what has high dependability.

[0016]

[Embodiment of the Invention] In this invention concerning claim 1, the point which pressure up is carried out more than the direct current voltage which the pressure-up chopper section means a means to change and output the direct current voltage which the rectification section outputs to the direct current voltage of arbitration, and the rectification section outputs especially, i.e., a rectification electrical potential difference, and can also be outputted is the description. This is enabled to amend the direct current voltage impressed to the power conversion section even more than said rectification electrical potential difference. Although the power conversion section means a means to change and output direct current voltage to the frequency adjustable and electrical-potential-difference adjustable alternating voltage and especially a configuration is not limited, it considers as the means which can carry out adjustable control of the frequency and electrical potential difference of an ac output by PWM control. A voltage variation detecting element means a means to detect change of the energy delivered and received between the output of said pressure-up chopper section, and said power conversion section as voltage variation, and detects it in the example with the electrical potential difference of the ends of the fixed resistor inserted between said pressure-up chopper sections and said power conversion sections. Said pressure-up chopper section includes the voltage variation corresponding to the power fluctuation accompanying the average electrical potential difference corresponding to the mean power outputted to said power conversion section, and the regeneration condition and power running condition of an induction motor in this electrical potential difference.

[0017] A fluctuation part detecting element means a means to extract only said voltage variation as an alternating current component, in the example, carries out the comparison plastic surgery of the output of said voltage variation detecting element with said average electrical potential difference with ejection and a comparator through a capacitor, and makes it a means to output the pulse corresponding to voltage variation. said pulse -- changing -- it corresponds to the frequency of the fluctuation with a regeneration condition and a power running condition from which it corresponds for changing and, as for pulse width, a regeneration condition and a power running condition change. In addition, timing means the timing of a regeneration condition and a power running condition.

[0018] Intrinsically, although wave operation part means a means to control said power

conversion section In this invention concerning claim 1 The output voltage V of said pressure-up chopper section Controlling the frequency F of said power conversion section, and keeping the ratio of V/F constant It controls in the direction which controls the regeneration condition and power running condition of an induction motor by amending output voltage V , the pressure-up chopper reference voltage command value which is each original command value about a frequency F , and a fundamental-frequency command value based on said voltage variation. At this time, the amount of regeneration frequency variation and the amount of power running frequency variation which amend said fundamental-frequency command value are calculated with predetermined relation from the pulse width of said pulse, and from said V/F ratio, the amount of regeneration voltage variation and the amount of power running voltage variation which amend the output voltage of the pressure-up chopper section balance said amount of regeneration frequency variation, and said amount of power running frequency variation, and are calculated, respectively.

[0019] the predetermined base -- time the output voltage of a frequency of said pressure-up chopper section is equal to said rectification electrical potential difference -- V/F -- the frequency decided from fixed relation is meant. therefore, the amended fundamental-frequency command value -- said base -- when exceeding a frequency, the output voltage of said pressure-up chopper section will be amended more highly than said rectification electrical potential difference.

[0020] In this invention concerning claim 2, a direct-current-voltage detecting element means a means to detect the output voltage of said pressure-up chopper section, and is not limited about a configuration. A direct-current section voltage variation detecting element means a means to detect the range of fluctuation in the direct current voltage detected by said direct-current-voltage detecting element, and is not limited about a configuration. Although a comparator means a means to output the coefficient of variation given by predetermined relation to an exceeded part exceeding a predetermined direct-current section fluctuation allowed value, corresponding to the range of fluctuation of said direct current voltage, outputs the coefficient of variation which is proportional to an exceeded part exceeding said direct-current section fluctuation allowed value in the example and sets to 1.0 below by said direct-current section fluctuation allowed value, it is not limited to this. This coefficient of variation is what reflects fluctuation of the output voltage of the pressure-up chopper section in said amount of regeneration voltage variation, and said amount of power running voltage variation. By carrying out multiplication to each of the amount of regeneration voltage variation in this invention concerning claim 1, and the amount of power running voltage variation, and enlarging amendment in proportion to the magnitude of the range of fluctuation, when fluctuation of the direct current voltage of the pressure-up chopper section is larger than said direct-current section fluctuation allowed value It acts as feedback which controls fluctuation of the direct current voltage of the pressure-up chopper section as a result, and aims at controlling an oscillation more effectively.

[0021] In this invention concerning claim 3 and claim 4 control of wave operation part Unlike this invention concerning claim 1 and claim 2, each the amendment of direct current voltage and the amendment of a frequency which are performed corresponding to said amount of frequency drifts are performed only in the power conversion section. the fundamental-frequency command value amended on the principle of not amending the output voltage of the pressure-up chopper section -- said base -- only when a frequency is exceeded, the amount of maximum regeneration voltage variation to this time has been added. Other configurations are the same as claim 1 thru/or claim 2.

[0022] Hereafter, the example of this invention is explained.

[0023]

[Example] (Example 1) It explains hereafter, referring to a drawing about the example 1 of the oscillating relief equipment in the conditioner of this invention. This example is involved in claim 1.

[0024] Drawing 1 is the block diagram showing the configuration of the inverter equipment in this example. In drawing 1, it is the induction motor with which the reactor by which 1 was carried out at the three-phase-alternating-current power source, and serial insertion of 2 was carried

out at the three-phase-alternating-current power source 1, and 3 drive inverter equipment, and 4 drives a compressor. The rectification section in which 5 rectifies the three-phase alternating current in inverter equipment 3, the pressure-up chopper section which carries out pressure up of the direct current voltage to which the rectification section 5 outputs 6, The DC-power-supply section by which 7 is constituted from the rectification section 5 and the pressure-up chopper section 6, the power conversion section which changes into frequency adjustable alternating voltage the direct current voltage to which the DC-power-supply section 7 outputs 8, The voltage variation detecting element to which 9 detects the voltage variation between the DC-power-supply section 7 and the power conversion section 8, The fluctuation part detecting element which detects a changed part in the voltage variation which detected 10 by the voltage variation detecting element 9, 11 -- the base -- the wave operation part which calculates the wave which controls the power conversion section 8 corresponding to a part for a frequency, a fundamental-frequency command value, and said fluctuation, and 12 are the pressure-up chopper armature-voltage control sections which control the pressure-up chopper section 6 corresponding to a part for a pressure-up chopper reference voltage command value and said fluctuation.

[0025] Drawing 2 is the block diagram showing the configuration of the voltage variation detecting element 9. As shown in drawing 2, it connected between the DC-power-supply section 7 and the power conversion section 8, for example, the voltage variation detecting element 9 changed change of a current into change of an electrical potential difference by fixed-resistor 9a etc., and after amplifying by amplifier 9b continuously, it has detected a changed part in voltage variation by removing an unnecessary frequency component through low pass filter 9c.

[0026] The actuation in the above-mentioned configuration is explained. Drawing 3 is the wave form chart showing actuation of the voltage variation detecting element 9 when the oscillation has occurred. In drawing 3, drawing 3 (a) shows the electrical potential difference generated in fixed-resistor 9a, and drawing 3 (b) shows the output of low pass filter 9c. In addition, drawing 3 (c) shows the output of the fluctuation part detecting element 10. In drawing 3 (a), a forward electrical potential difference shows the regeneration condition which is in the condition that inverter equipment 3 is turned to the induction motor 4, and the negative electrical potential difference shows the power running condition which is in the condition that inverter equipment 3 turns an induction motor 4 too much. Moreover, the voltage variation shown in drawing 3 (a) is obtained by the output of drawing 3 (b) as an alternating current component superimposed on an in one direction flowed part. The core of the amplitude of this alternating current component is an average electrical potential difference corresponding to mean power. The output of this voltage variation detecting element 9 is inputted into the fluctuation part detecting element 10.

[0027] Drawing 4 is the block diagram showing the configuration of the fluctuation part detecting element 10. In drawing 4, 10a is [a fixed resistor and 10d of a capacitor, and 10b and 10c] comparators. In the fluctuation part detecting element 10, capacitor 10a extracts only said alternating current component from the output of the voltage variation detecting element 9, and by comparator 10d, as shown in drawing 3 (c), a pulse shaping is carried out and it outputs to the wave operation part 11. This configuration enables it to catch a changing point to the accuracy to an average electrical potential difference, when the criteria of voltage variation are partial. This changing point is equivalent to the changing point of mean power. The output of the fluctuation part detecting element 10 is inputted into the wave operation part 11.

[0028] Hereafter, it explains, referring to a drawing about actuation of the wave operation part 11. Drawing 5 is a flow chart which shows actuation of the wave operation part 11.

[0029] First, in step 1, it checks whether the measurement between edges of the input pulse from the fluctuation part detecting element 10 is completed. When measurement is not completed, it shifts to step 5, but when measurement is completed at step 1, it shifts to step 2 and the input of the current wave operation part 11 is checked. Here, since the input of the wave operation part 11 is a pulse and measurement is completed before it when this time is Hi, the object of measurement between the edge serves as the section of Low level. Similarly, if the input of the wave operation part 11 is Low at present, since measurement is completed before it,

the object of measurement between the edge will serve as the section of Hi level.

[0030] When an input pulse is Hi, it shifts to step 3, and the measurement result is stored as data at the time of regeneration, the amount of frequency drifts at the time of regeneration is calculated according to the relation of drawing 6, and it shifts to step 5. Moreover, when an input pulse is Low, it shifts to step 4, and a measurement result is stored as data at the time of power running, the amount of frequency drifts at the time of power running is similarly calculated from the measured pulse width according to the relation of drawing 6, and it shifts to step 5. At step 5, the condition of a current input pulse is supervised and a falling edge is detected. This detects the changing point of a power running condition and a regeneration condition.

[0031] In step 5, when a falling edge is detected, it shifts to step 6 and a fundamental-frequency command value is changed according to a degree type.

fundamental-frequency command value \leftarrow the amount of fundamental-frequency command value + regeneration frequency drifts -- the next -- step 7 -- shifting -- a fundamental-frequency command value and the base -- a frequency -- comparing -- a fundamental-frequency command value -- the base -- when it is under a frequency, it shifts to step 8. At step 8, since it is unnecessary, the oscillating relief control by the pressure-up chopper calculates a degree type, and ends processing.

amount = of regeneration voltage variation 0 -- again -- step 7 -- a fundamental-frequency command value -- the base -- when it is more than a frequency, it shifts to step 9, and the amount of regeneration voltage variation outputted to the pressure-up chopper armature-voltage control section 12 according to a degree type is calculated.

the amount \times unit change electrical potential difference of amount = regeneration frequency drifts of regeneration voltage variation -- here, a unit change electrical potential difference is fundamental frequency, for example, the electrical-potential-difference value per Hz, and is an amount equivalent to the inclination of V/F.

[0032] Moreover, when the falling edge is not detectable at step 5, it shifts to step 10 and a rising edge is detected. When a rising edge is detected, it shifts to step 11 and a fundamental-frequency command value is changed according to a degree type. fundamental-frequency command value \leftarrow the amount of fundamental-frequency command value-power running frequency variation -- the case where it detects although it ended here when a rising edge was not able to be detected, either -- step 12 -- shifting -- a fundamental-frequency command value -- the base -- a frequency -- comparing -- a fundamental-frequency command value -- the base -- when it is under a frequency, it shifts to step 14.

[0033] At step 14, since it is unnecessary, the oscillating relief control by the pressure-up chopper calculates a degree type, and ends processing.

amount = of power running voltage variation 0 -- again -- step 12 -- a fundamental-frequency command value -- the base -- when it is more than a frequency, it shifts to step 13, and the amount of power running voltage variation outputted to the pressure-up chopper armature-voltage control section 12 according to a degree type is calculated.

The amount of power running voltage variation = by processing more than an amount of power running frequency drifts \times unit change electrical potential difference, the wave operation part 11 calculates the amount of regeneration voltage variation, and the amount of power running voltage variation. In addition, since a process after determining a fundamental-frequency command value until it outputs an PWM signal is a general content, it omits explanation. Moreover, about change to the fundamental-frequency command value [frequency / current] which newly did the operation again, acceleration and deceleration are smoothly carried out with a predetermined rate.

[0034] Below, the pressure-up chopper armature-voltage control section 12 is explained. The pressure-up chopper armature-voltage control section 12 adjusts the amount of regeneration voltage variation or the amount of power running voltage variation calculated by the wave operation part 11 to a pressure-up chopper reference voltage command value, and determines a target electrical potential difference. Drawing 7 is a flow chart which shows actuation of the pressure-up chopper section 6 in this example. As shown below, the output voltage of the pressure-up chopper section 6 is smoothly changed according to said target electrical potential

difference.

[0035] First, in step 1, it checks whether it is the timing of power running control. When it is the timing of power running control, it shifts to step 2, and when it is not the timing of power running control, it shifts to step 4. At step 2, it checks whether current output voltage has reached the target electrical potential difference at the time of power running control. When having reached, processing is ended, and when having not reached, it shifts to step 3. At step 3, output voltage is updated according to a degree type, and the back processing is ended.

Pressure-up output voltage = in not being a pressure-up chopper reference voltage command value-unit change electrical potential difference and the timing of power running control, it shifts to step 4. At step 4, it checks whether current output voltage has reached the target electrical potential difference in a regeneration condition. When having reached, processing is ended, and when having not reached, it shifts to step 5. At step 5, processing is ended, after performing renewal of output voltage according to a degree type.

Pressure-up output voltage = Since it is in the condition that inverter equipment 3 is turned to the induction motor 4 at the time of regeneration by repeating the processing more than a pressure-up chopper reference voltage command value + unit change electrical potential difference, The output frequency and output voltage of inverter equipment 3 so that it may be negated at the time of raising and power running Since it is in the condition that inverter equipment 3 turns an induction motor 4 too much, By lowering the output frequency and output voltage of inverter equipment 3 so that it may be negated Fluctuation of the energy of the pressure-up chopper section 6 and the power conversion section 8 is controlled, and it can mitigate the oscillation generated in a compressor while it will be in the condition of having been stabilized over the operation frequency whole region of inverter equipment 3.

[0036] According to this example, as mentioned above by extracting a changed part in the voltage variation between the DC-power-supply section 7 and the power conversion section 8 as an alternating current component A changing point is exactly detectable even if voltage variation inclines toward either regeneration or power running. Moreover, by controlling amending fundamental frequency and the output voltage of a pressure-up chopper based on the pulse width of the pulse which operated the wave of said alternating current component orthopedically in the direction which negates a revolution of an induction motor 4 in each at the time of regeneration and power running actuation of the above mitigable [the oscillation generated in a compressor] to stability and -- the base -- since it is possible to more than a frequency, an oscillation is mitigable over the whole region of operation frequency.

[0037] (Example 2) It explains hereafter, referring to a drawing about the example 2 of the oscillating relief equipment of the conditioner of this invention. This example is involved in claim 2.

[0038] Drawing 8 is the block diagram showing the configuration of the inverter equipment 3 in this example. In addition, the same number is given to the same component as drawing 1, and detailed explanation is omitted. In drawing 8 R> 8, the direct-current-voltage detecting element which detects the direct current voltage to which the DC-power-supply section 7 outputs 13, the direct-current section voltage variation detecting element to which 14 detects the fluctuation in said direct current voltage, and 15 are comparators [a direct-current section fluctuation allowed value / fluctuation / in direct current voltage].

[0039] The point that this example differs from an example 1 has the wave operation part 11 in having computed the amount of regeneration voltage variation, and the amount of power running voltage variation by considering a changed part of the direct current voltage which the DC-power-supply section 7 outputs. About other actuation, it is the same as that of an example 1.

[0040] It explains referring to a drawing about the actuation in the above-mentioned configuration. Drawing 9 is a flow chart which shows actuation of the wave operation part 11 in this example. In addition, since it is the same processing if the case where the judgment result of step 12 is YES is removed when the judgment result of step 7 is YES in the flow chart shown in drawing 5 of an example 1 and, the explanation about these is omitted.

[0041] step 7 -- a fundamental-frequency command value -- the base -- when it is more than a frequency, it shifts to step 9. At step 9, the amount of regeneration voltage variation outputted

to the pressure-up chopper armature-voltage control section 12 according to a degree type is calculated.

the amount \times unit change electrical potential difference of amount = coefficient-of-variation \times regeneration frequency drifts of regeneration voltage variation -- here, coefficient of variation shows extent when the range of fluctuation of the direct current voltage of the midst to which oscillating relief control is applied is over the direct-current section fluctuation allowed value, and shows the relation between the range of fluctuation of direct current voltage, and coefficient of variation to drawing 10.

[0042] moreover, the step 12 -- a fundamental-frequency command value -- the base -- when it is more than a frequency, it progresses to step 13. At step 13, the amount of power running voltage variation outputted to the pressure-up chopper armature-voltage control section 12 according to a degree type is calculated.

The amount of power running voltage variation = by processing more than an amount of coefficient-of-variation \times power running frequency drifts \times unit change electrical potential difference, the wave operation part 11 computes the amount of regeneration voltage variation, and the amount of regeneration voltage variation. In addition, since a process after determining a fundamental-frequency command value until it outputs an PWM signal is a general content, it omits explanation. Moreover, about change to the fundamental-frequency command value [frequency / current] which newly did the operation again, acceleration and deceleration are smoothly carried out with a predetermined rate.

[0043] Below, actuation of the direct-current-voltage detecting element 13 thru/or a comparator 15 is explained. In the direct-current section voltage variation detecting element 14, the maximum electrical potential difference and the minimum electrical potential difference are detected from the output of the direct-current-voltage detecting element 13, the range of fluctuation of direct current voltage is calculated from the value, and it outputs to a comparator 15. In a comparator 15, when the range of fluctuation of direct current voltage is the range of fluctuation of said direct current voltage over the direct-current section fluctuation allowed value as compared with the predetermined direct-current section fluctuation allowed value, according to the relation of drawing 10, coefficient of variation is outputted to the wave operation part 11. When the range of fluctuation of direct current voltage is below a direct-current section fluctuation allowed value, it outputs to the wave operation part 11, using coefficient of variation as 1.

[0044] Since it is in the condition that inverter equipment 3 is turned to the induction motor 4 by repeating the above processing at the time of regeneration, The output frequency and output voltage of inverter equipment 3 so that it may be negated at the time of raising and power running Since it is in the condition that inverter equipment 3 turns an induction motor 4 too much, By lowering the output frequency and output voltage of inverter equipment 3 so that it may be negated Fluctuation of the energy of the pressure-up chopper section 6 and the power conversion section 8 is controlled, and it can mitigate the oscillation generated in a compressor while it will be in the condition of having carried out rear-spring-supporter stability throughout the operation frequency of inverter equipment 3.

[0045] Furthermore, high oscillating relief control of precision can be further performed by correcting the range of fluctuation of an electrical potential difference used for oscillating relief control so that it may be completed by oscillation by feeding back fluctuation of direct current voltage by the direct-current-voltage detecting element 13.

[0046] According to this example, an oscillation is further mitigable from the configuration of an example 1 to high degree of accuracy as mentioned above by enlarging the amount of regeneration voltage variation, and the amount of power running voltage variation, and controlling them based on the range of fluctuation of the output direct current voltage of the DC-power-supply section 7.

[0047] (Example 3) It explains hereafter, referring to a drawing about the example 3 of the oscillating relief equipment in the conditioner of this invention.

[0048] Drawing 11 is the block diagram showing the configuration of the inverter equipment 3 in this example. If a block diagram shows the configuration of this example, it is the same as an

example 1.

[0049] the fundamental-frequency command value which amended the point that this example differed from an example 1, corresponding to voltage variation -- the base -- when a frequency is exceeded, it is in only the amount of maximum regeneration voltage variation to this time fixing the pressure-up output voltage of the pressure-up chopper section 6, changing the frequency and output voltage of inverter equipment 3 by raising and processing of the wave operation part 11, and having reduced the oscillation of an induction motor 4. Therefore, processing of the pressure-up chopper armature-voltage control section 12 is simplified.

[0050] It explains referring to a drawing about the actuation in the above-mentioned configuration. Drawing 12 is a flow chart which shows actuation of the wave operation part 11 in this example. In addition, in drawing 12 R> 2, about processing to the fluctuation part detecting element 10, it is the same as that of an example 1, and explanation is omitted. Moreover, also about processing to step 8, step 9 and step 13, and step 14, it is the same as that of an example 1, and explanation is omitted.

[0051] At step 15, the maximum of the amount of regeneration voltage variation calculated in step 9 each time is judged. The amount of regeneration voltage variation calculated this time is shifted to step 16, when the amount of regeneration voltage variation is more than the amount of maximum regeneration voltage variation as compared with the amount of maximum regeneration voltage variation to last time, and the amount of maximum regeneration voltage variation is updated, and it shifts to step 17. Moreover, when the amount of regeneration voltage variation is under the amount of maximum regeneration voltage variation, it shifts to step 17. At step 17, acquisition of a phase update process and output voltage data is performed, and it shifts to step 18. Since it is general processing in the inverter equipment controlled by the PWM wave about the processing in this step 17, explanation is omitted.

[0052] At step 18, the direct current voltage which increases by the pressure-up chopper section 6 is amended according to a degree type, and it shifts to step 19.

Pressure-up output voltage = at the amount step 19 of pressure-up chopper reference voltage command value + maximum regeneration voltage variation, it checks whether the current frequency has reached the fundamental-frequency command value. When having reached, processing is ended, and when having not reached, it shifts to step 20. At step 20, according to a degree type, output voltage is changed and processing is ended.

output voltage <- an output voltage-unit change electrical potential difference -- below, the processing at the time of power running is explained. At step 21, like the time of regeneration, acquisition of a phase update process and output voltage data is performed, and it shifts to step 22. At step 22, the direct current voltage which increases by the pressure-up chopper section 6 is amended like the time of regeneration according to a degree type, and it shifts to step 23.

Pressure-up output voltage = the amount of maximum regeneration voltage variation is used at the time of the amount power running of pressure-up chopper reference voltage command value + maximum regeneration voltage variation, because it has amended as a rule of thumb.

[0053] At step 23, it checks whether the current frequency has reached the fundamental-frequency command value. When having reached, processing is ended, and when having not reached, it shifts to step 24. At step 24, output voltage is changed according to a degree type, and processing is ended.

output voltage <- an output voltage + unit change electrical potential difference -- below, the pressure-up chopper armature-voltage control section 12 shown in drawing 12 is explained.

Drawing 13 is a flow chart which shows actuation of the pressure-up chopper armature-voltage control section 12. In step 1, it judges whether current and oscillating relief control are performed. In oscillating relief being under control, it progresses to step 2, and when it is not [oscillating relief] under control, it shifts to step 3. At step 2, in order to change the output voltage of the pressure-up chopper section 6, according to a degree type, a pressure-up chopper reference voltage command value is changed, and an activity is ended.

Pressure-up chopper reference voltage command value <- When it is judged that the oscillation has not occurred in the amount step 1 of pressure-up chopper reference voltage command value + maximum regeneration voltage variation, it shifts to step 3. At step 3, since the

oscillation has not occurred, a pressure-up chopper reference voltage command value is returned to the original pressure-up chopper reference voltage command value, and processing is ended. Moreover, about the process which generates the pulse which drives the pressure-up chopper section 6 by the pressure-up chopper armature-voltage control section 12, since it is the general content of processing, explanation is omitted.

[0054] Since it is in the condition that inverter equipment 3 is turned to the induction motor 4 in the operation frequency whole region of inverter equipment 3 by repeating the above processing at the time of regeneration by the increment in an electrical potential difference of the necessary minimum DC-power-supply section 7, The output frequency and output voltage of inverter equipment 3 so that it may be negated at the time of raising and power running Since it is in the condition that inverter equipment 3 turns an induction motor 4 too much, By lowering the output frequency and output voltage of inverter equipment 3, fluctuation of the energy of the pressure-up chopper section 6 and the power conversion section 8 is controlled so that it may be negated, and while being in the condition of having been stabilized, the oscillation generated in a compressor is mitigable.

[0055] Moreover, in the pressure-up chopper section 6, a necessary minimum electrical potential difference can be raised by oscillating relief control, and the minute control for mitigating an oscillation can simplify control of ** which the wave operation part 11 took charge of, and the pressure-up chopper section 6.

[0056] According to this example, the amount of maximum regeneration voltage variation of the amount of regeneration voltage variation is updated as mentioned above. In exceeding a frequency, it amends the pressure-up output voltage of the pressure-up chopper section 6 in said amount of maximum regeneration voltage variation. the fundamental-frequency command value changed corresponding to the voltage variation between the DC-power-supply section 7 and the power conversion section 8 -- the base -- While mitigating the oscillation generated in a compressor by controlling in the direction which changes the frequency and output voltage of inverter equipment 3 into the basis of the pressure-up output voltage, and negates the regeneration condition or power running condition of an induction motor 4, processing of the pressure-up chopper section 6 can be simplified.

[0057] (Example 4) It explains hereafter, referring to a drawing about the example 4 of the oscillating relief equipment in the conditioner of this invention. This example is involved in claim 4.

[0058] Drawing 14 is the block diagram showing the configuration of the inverter equipment 3 in this example. In addition, if a block diagram shows the configuration of this example, it will become the same as drawing 8 of an example 3, the same number will be given to the same component, and detailed explanation will be omitted. The point that this example differs from an example 3 is like an example 2 in control of the wave operation part 11 to have considered the coefficient of variation corresponding to the range of fluctuation of the direct current voltage of the pressure-up chopper section 6.

[0059] It explains referring to a drawing about the actuation in the above-mentioned configuration. Drawing 15 is a flow chart explaining actuation of the wave operation part 11 in this example. In addition, in drawing 15, about processing to the fluctuation part detecting element 10, it is the same as that of an example 1, and explanation is omitted. Moreover, if step 9 and step 13 are removed, it is the same as that of an example 3, and explanation is omitted.

[0060] At step 9, the amount of regeneration voltage variation is calculated according to a degree type.

The amount of regeneration voltage variation = at an amount of coefficient-of-variation x regeneration frequency drifts x unit change electrical potential difference, and step 13, the amount of power running voltage variation is calculated according to a degree type.

The amount of power running voltage variation = said coefficient of variation is the same as the coefficient of variation in an example 3 which is an amount of coefficient-of-variation x power running frequency drifts x unit change electrical potential difference. Moreover, about the pressure-up chopper armature-voltage control section 12, since it is the same content as what was explained in the example 3, explanation is omitted. Moreover, the process from direct-

current-voltage detection of the direct-current-voltage detecting element 13 to the operation of the coefficient of variation in a comparator 15 is the same as an example 2. That is, this example raises the control precision over an oscillation by adding electrical-potential-difference feedback to an example 3.

[0061] Since it is in the condition that inverter equipment 3 is turned to the induction motor 4 in the operation frequency whole region of inverter equipment 3 by repeating the above processing at the time of regeneration by the increment in an electrical potential difference of the necessary minimum DC-power-supply section, The frequency and output voltage of inverter equipment 3 so that it may be negated at the time of raising and power running Since it is in the condition that inverter equipment 3 turns an induction motor 4 too much, While fluctuation of the energy of the pressure-up chopper section 6 and the power conversion section 8 will be in the condition of it having been controlled and having been stabilized, by lowering the frequency and output voltage of inverter equipment 3 so that it may be negated, the oscillation generated in a compressor is mitigable.

[0062] moreover, the amended fundamental-frequency command value -- the base -- the case where a frequency is exceeded -- an example 3 -- the same -- the pressure-up output voltage of the pressure-up chopper section 6 -- the minimum -- since the wave operation part 11 takes charge of minute control only for the required amount of maximum regeneration voltage variation to mitigate raising and an oscillation, it can simplify processing of the pressure-up chopper armature-voltage control section 12.

[0063] Furthermore, high oscillating relief control of precision can be further performed by feeding back fluctuation of the direct current voltage which the pressure-up chopper section 6 outputs like an example 2.

[0064] According to this example, based on the voltage variation between the DC-power-supply section 7 and the power conversion section 8, and fluctuation of the direct current voltage of the DC-power-supply section 7, the amount of regeneration voltage variation and the amount of power running voltage variation are calculated as mentioned above. Raising [in exceeding a frequency, fix the pressure-up output voltage of the pressure-up chopper section with the amount of maximum regeneration voltage variation to this time, and] the fundamental-frequency command value amended based on them -- the base -- Processing of the pressure-up chopper armature-voltage control section can be simplified reducing an oscillation of an induction motor more effectively by controlling a frequency and output voltage in the direction which negates the regeneration condition and power running condition of an induction motor on the basis of the pressure-up output voltage, respectively.

[0065]

[Effect of the Invention] In the conditioner equipped with the inverter equipment which this invention concerning claim 1 inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, Based on the pulse width and timing of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are

calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said pressure-up chopper section It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. Have the wave operation part which controls said power conversion section and said pressure-up chopper armature-voltage control section, amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition, and said wave operation part is set to said amendment. the predetermined base -- by considering as the oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to the range more than the output voltage of said rectification section corresponding to said fundamental-frequency command value after amendment exceeding a frequency Fluctuation of the energy delivered and received between the DC-power-supply section and the power conversion section is not judged with a polarity. While becoming cheap by catching fluctuation of energy exactly and using a fixed resistor for a detector when criteria are partial in order to find out and control the fluctuation as the whole Oscillating relief control can be performed by controlling the pressure-up chopper section also in the field beyond a frequency. the operation frequency of an induction motor -- the base -- the oscillation generated in the compressor of a conditioner is mitigated -- making -- further -- the base -- since only an initial complement raises the electrical potential difference of the DC-power-supply section only when required, the field odor more than a frequency cannot affect the life of the capacitor for smooth, but can make it what has high dependability.

[0066] In the conditioner equipped with the inverter equipment which this invention concerning claim 2 inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, The direct-current-voltage detecting element which detects the output voltage of said pressure-up chopper section, and the direct-current section voltage variation detecting element which detects said detected range of fluctuation of direct current voltage, The comparator which will output the coefficient of variation corresponding to an exceeded part if said range of fluctuation exceeds said direct-current section fluctuation allowed value for the range of fluctuation of said direct current voltage as compared with a predetermined direct-current section fluctuation allowed value, Based on the pulse width, the timing, and said coefficient of variation of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said pressure-up chopper section It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. Have the wave operation part which controls said power conversion section and said pressure-up chopper armature-voltage control section, amending in the direction which mitigates the oscillation by the repeat of the

regeneration condition of said induction motor, and a power running condition, and said wave operation part is set to said amendment. the predetermined base -- to said fundamental-frequency command value after amendment exceeding a frequency by considering as the oscillating relief equipment in the conditioner which amended the output voltage of said pressure-up chopper section to more than the output voltage of said rectification section When the criteria of change of the energy delivered and received between the pressure-up chopper section and the power conversion section are partial, the changing point of transfer of energy can be caught exactly. And the range of fluctuation of said output voltage supervises, and fluctuation of said output voltage is made small as a result by reflecting this range of fluctuation in control. furthermore, the base predetermined in the operation frequency of an induction motor -- since the output voltage of the pressure-up chopper section is controllable also in the field beyond a frequency, it can cross throughout the output range of inverter equipment, and the oscillation generated with a more sufficient precision in the compressor of a conditioner can be made to mitigate moreover, the output voltage of said pressure-up chopper section -- said base -- only in the field more than a frequency, since it raises as required, the life of the capacitor for smooth with which said pressure-up chopper section is equipped is not affected, but it is made to what has high dependability.

[0067] In the conditioner equipped with the inverter equipment which this invention concerning claim 3 inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, Based on the pulse width and timing of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said alternating current It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. It has the wave operation part which controls said power conversion section while amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition. Said wave operation part In said amendment the predetermined base -- by using output voltage of said pressure-up chopper section as the oscillating relief equipment in the conditioner amended on the addition electrical potential difference of the output voltage of said rectification section, and the amount of maximum regeneration voltage variation calculated by this time to said fundamental-frequency command value after amendment exceeding a frequency When the criteria of change of the energy delivered and received between the pressure-up chopper section and the power conversion section are partial, the changing point of transfer of energy can be caught exactly. moreover, the base predetermined in the operation frequency of an induction motor, when only the amount of maximum regeneration voltage variation raises and controls the output voltage of the pressure-up chopper section in the field beyond a frequency The oscillation cheaply generated in the compressor of a conditioner over the output range whole region of inverter equipment can be

made to mitigate, simplifying control of the pressure-up chopper armature-voltage control section. moreover, the output voltage of said pressure-up chopper section -- said base -- only in the field more than a frequency, since it raises as required, the life of the capacitor for smooth with which said pressure-up chopper section is equipped is not affected, but it is made to what has high dependability.

[0068] In the conditioner equipped with the inverter equipment which this invention concerning claim 4 inputs alternating current power through a reactor from a three-phase-alternating-current power source, and supplies the frequency adjustable and electrical-potential-difference adjustable alternating current power to an induction motor The rectification section in which said inverter equipment rectifies the alternating voltage of said three-phase-alternating-current power source, The pressure-up chopper section which changes and outputs the direct current voltage which said rectification section outputs to the direct current voltage of arbitration, The power conversion section which changes into the frequency adjustable and electrical-potential-difference adjustable alternating voltage the direct current voltage which said pressure-up chopper section outputs, The voltage variation detecting element which detects change of the energy delivered and received between said pressure-up chopper sections and said power conversion sections as electrical-potential-difference change, The fluctuation part detecting element which extracts only the alternating current component in the output of said voltage variation detecting element, and outputs the pulse corresponding to a large part and a small part as compared with an average electrical potential difference, The pressure-up chopper armature-voltage control section which controls the output voltage of said pressure-up chopper section, The direct-current-voltage detecting element which detects the output voltage of said pressure-up chopper section, and the direct-current section voltage variation detecting element which detects said detected range of fluctuation of direct current voltage, The comparator which will output the coefficient of variation corresponding to an exceeded part if said range of fluctuation exceeds said direct-current section fluctuation allowed value for the range of fluctuation of said direct current voltage as compared with a predetermined direct-current section fluctuation allowed value, Based on the pulse width, the timing, and said coefficient of variation of said pulse, the amount of regeneration voltage variation corresponding to the regeneration condition of said induction motor and the amount of power running voltage variation corresponding to a power running condition are calculated. The fundamental-frequency command value which directs the frequency of the alternating current which said power conversion section outputs, and the output voltage of said alternating current It is based on said amount of regeneration voltage variation, and said power running condition in said amount of power running voltage variation at said regeneration condition. It has the wave operation part which controls said power conversion section while amending in the direction which mitigates the oscillation by the repeat of the regeneration condition of said induction motor, and a power running condition. Said wave operation part In said amendment the predetermined base -- by using output voltage of said pressure-up chopper section as the oscillating relief equipment in the conditioner amended on the addition electrical potential difference of the output voltage of said rectification section, and the amount of maximum regeneration voltage variation calculated by this time to said fundamental-frequency command value after amendment exceeding a frequency When the criteria of change of the energy delivered and received between the pressure-up chopper section and the power conversion section are partial, the changing point of transfer of energy can be caught exactly. And the range of fluctuation of said output voltage supervises, and fluctuation of said output voltage is made small as a result by reflecting this range of fluctuation in control. furthermore, the base predetermined in the operation frequency of an induction motor, when only the amount of maximum regeneration voltage variation raises and controls the output voltage of the pressure-up chopper section in the field beyond a frequency It can cross throughout the output range of inverter equipment, simplifying control of the pressure-up chopper armature-voltage control section, and the oscillation generated with a more sufficient precision in the compressor of a conditioner can be made to mitigate. moreover, the output voltage of said pressure-up chopper section -- said base -- only in the field more than a frequency, since it raises as required, the life of the capacitor for smooth with which said

pressure-up chopper section is equipped is not affected, but it is made to what has high dependability.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the configuration of the inverter equipment in the example 1 of this invention

[Drawing 2] The block diagram showing the configuration of the voltage variation detecting element in this example

[Drawing 3] The wave form chart showing actuation of the voltage variation detecting element in this example

[Drawing 4] The block diagram showing the configuration of the fluctuation part detecting element in this example

[Drawing 5] The flow chart which shows actuation of the wave operation part in this example

[Drawing 6] Property drawing showing the relation of the pulse width of an input pulse and the amount of frequency drifts in this example

[Drawing 7] The flow chart which shows actuation of the pressure-up chopper armature-voltage control section in this example

[Drawing 8] The block diagram showing the configuration of the inverter equipment in the example 2 of this invention

[Drawing 9] The flow chart which shows actuation of the inverter equipment in this example

[Drawing 10] Property drawing showing the relation of the range of fluctuation of direct current voltage and coefficient of variation in this example

[Drawing 11] The block diagram showing the configuration of the inverter equipment in the example 3 of this invention

[Drawing 12] The flow chart which shows actuation of the wave operation part in this example

[Drawing 13] The flow chart which shows actuation of the pressure-up chopper armature-voltage control section in this example

[Drawing 14] The block diagram showing the configuration of the inverter equipment in the example 4 of this invention

[Drawing 15] The flow chart which shows actuation of the wave operation part in this example

[Drawing 16] The wave form chart showing the current which flows between the DC-power-supply section and the power conversion section at the time of the oscillation in the conventional example

[Description of Notations]

1 Three-phase-Alternating-Current Power Source

2 Reactor

3 Inverter Equipment

4 Induction Motor

5 Rectification Section

6 Pressure-Up Chopper Section

7 DC-Power-Supply Section

8 Power Conversion Section

9 Voltage Variation Detecting Element

9a Fixed resistor

9b Amplifier
9c Low pass filter
10 Fluctuation Part Detecting Element
10a Capacitor
10b, 10c Fixed resistor
10d Comparator
11 Wave Operation Part
12 Pressure-Up Chopper Armature-voltage Control Section
13 Direct-Current-Voltage Detecting Element
14 Direct-Current Section Voltage Variation Detecting Element
15 Comparator

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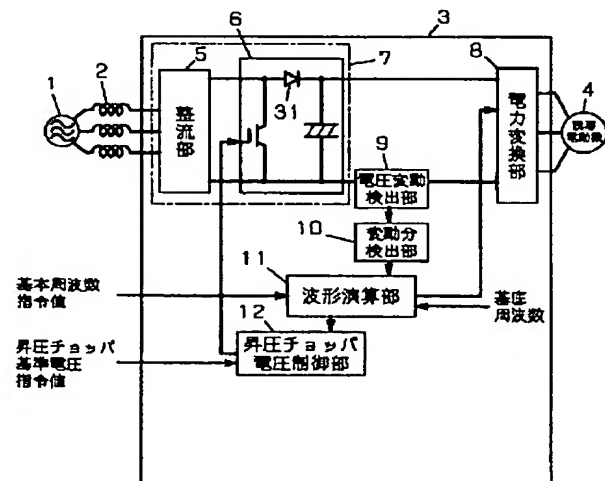
(54)【発明の名称】 空気調和装置における振動軽減装置

(57)【要約】

【課題】 インバータ装置で駆動される空気調和装置の誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する空気調和装置の振動軽減装置を提供する。

【解決手段】 インバータ装置3において、電圧変動検出部9により、直流電源部7と電力交換部8との間で授受されるエネルギーの変動を電圧変動として検出し、変動分検出部10により前記電圧変動における変動分のみを抽出した交流成分を波形整形したパルスを出力し、波形演算部11は、回生状態と力行状態とに対応する前記パルスのパルス幅に基づいて回生周波数変動量と力行周波数変動量とを演算し、電力交換部8の周波数を指示する基本周波数指令値と、昇圧チョッパ部6の出力電圧を指示する昇圧チョッパ基準電圧指令値とを、回生時には前記回生周波数変動量、力行時には前記力行周波数変動量に基づいて補正することにより振動を抑制する方向に制御する。

- 1 三相交流電源
- 2 リアクタ
- 3 インバータ装置
- 6 昇圧チョッパ部
- 7 直流電源部



【特許請求の範囲】

【請求項1】 三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記パルスのパルス幅とタイミングとに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記昇圧チョッパ部の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する方向に補正しながら前記電力変換部と前記昇圧チョッパ電圧制御部とを制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値に対応して前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧以上の範囲まで補正するようにした空気調和装置における振動軽減装置。

【請求項2】 三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記昇圧チョッパ部の出力電圧を検出する直流電圧検出部と、前記検出した直流電圧の変動幅を検出する直流部電圧変動検出部と、前記直流電圧の変動幅を所定の直流部変動許容値と比較し、前記変動幅が前記直流部変動許容値を超えると超過分に対応した変動係数を出力する比較部と、前記パルスのパルス幅と

タイミングと前記変動係数とに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記昇圧チョッパ部の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する方向に補正しながら前記電力変換部と前記昇圧チョッパ電圧制御部とを制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値には前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧以上まで補正するようにした空気調和装置における振動軽減装置。

【請求項3】 三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記パルスのパルス幅とタイミングとに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記交流の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する方向に補正しながら前記電力変換部を制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値に対しては前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧と現時点までに演算した最大回生電圧変動量との加算電圧に補正するようにした空気調和装置における振動軽減装置。

【請求項4】 三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を

周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記昇圧チョッパ部の出力電圧を検出する直流電圧検出部と、前記検出した直流電圧の変動幅を検出する直流部電圧変動検出部と、前記直流電圧の変動幅を所定の直流部変動許容値と比較し、前記変動幅が前記直流部変動許容値を超えると超過分に対応した変動係数を出力する比較部と、前記パルスのパルス幅とタイミングと前記変動係数とに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記交流の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰返しによる振動を軽減する方向に補正しながら前記電力変換部を制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値に対しては前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧と現時点までに演算した最大回生電圧変動量との加算電圧に補正するようにした空気調和装置における振動軽減装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、圧縮機をPWM方式電圧形のインバータ装置により駆動する空気調和装置における振動軽減装置に関する。

【0002】

【従来の技術】以下、従来の空気調和装置について説明する。PWM方式電圧形のインバータ装置によりV/Fを一定にして圧縮機を駆動した場合、運転周波数、誘導電動機の電気定数、および負荷の状態などにより、異常な振動が発生する場合がある。

【0003】この振動が発生した場合、その振動を抑制する制御手段として、たとえば特公平5-28078号公報に開示された装置がある。この手段では、直流電源部と電力変換部との間に流れる電流の極性とその周期とを検出し、前記極性と前記周期の長さとはに応じて基本周波数指令値を補正することにより振動を防止するようにしている。

【0004】

【発明が解決しようとする課題】このような従来の空気調和装置の振動軽減手段では、直流電源部と電力変換部との間に流れる電流の極性により、力行、または回生の判断を行っているため、空気調和装置の圧縮機を駆動さ

せて、ある程度の負荷のかかっている状況で振動が発生している場合において、負の電流が流れている区間でのみ検出では、図16に示したように、エネルギーの変動が片寄って変化している場合に正確に変動の基準を検出できず、この信号を基本として振動軽減制御を行うため、エネルギー変動の基準が正確につかめない場合には振動軽減制御をかけるタイミングがずれ、結果として安定性が低下すると言う問題が発生する。

【0005】また、直流電源部と電力変換部との間に流れる電流の検出器として非接触の交流器を用いているが、前記非接触の交流器は比較的高価であり、コストの点で空気調和装置には適用しづらいのが現状である。

【0006】さらに、従来の構成では、整流部にダイオードを用いた全波整流方式を採用するため、直流電源部の最大電圧は電源電圧で決定され、基底周波数以上の領域で振動が発生している場合、前記最大電圧以上に電圧を増加させることができないため、振動軽減制御は不可能となっていた。

【0007】本発明は上記の課題を解決するもので、直流電源部と電力変換部との間のエネルギーの変化の基準が片寄っている場合においても、エネルギーの変化を的確に捉え、かつ、基底周波数以上の領域においても効果を発揮できる空気調和装置の振動軽減装置を提供することを目的とする。

【0008】

【課題を解決するための手段】請求項1に係わる本発明は、三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記パルスのパルス幅とタイミングとに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記昇圧チョッパ部の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰返しによる振動を軽減する方向に補正しながら前記電力変換部と前記昇圧チョッパ電圧制御部とを制御する波形演算部とを備え、前記波形演算

部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値に対応して前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧以上の範囲まで補正するようにした空気調和装置における振動軽減装置である。

【0009】本発明により、昇圧チョッパ部と電力変換部との間で授受されるエネルギーの変化の基準が片寄っている場合においてもエネルギーの授受の変化点を的確に捉えることができ、また、誘導電動機の運転周波数が所定の基底周波数を超えた領域においても昇圧チョッパ部の出力電圧を制御できるので、インバータ装置の出力範囲全域にわたって安価に空気調和装置の圧縮機に発生する振動を軽減させることができる。また、前記昇圧チョッパ部の出力電圧は前記基底周波数以上の領域においてのみ、かつ必要なだけ上げるので、前記昇圧チョッパ部が備える平滑用コンデンサの寿命に影響を与えず、信頼性の高いものにできる。

【0010】請求項2に係わる本発明は、三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記昇圧チョッパ部の出力電圧を検出する直流電圧検出部と、前記検出した直流電圧の変動幅を検出する直流部電圧変動検出部と、前記直流電圧の変動幅を所定の直流部変動許容値と比較し、前記変動幅が前記直流部変動許容値を超えると超過分に対応した変動係数を出力する比較部と、前記パルスのパルス幅とタイミングと前記変動係数とに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記昇圧チョッパ部の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する方向に補正しながら前記電力変換部と前記昇圧チョッパ電圧制御部とを制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値には前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧以上まで補正す

るようにした空気調和装置における振動軽減装置である。

【0011】本発明により、昇圧チョッパ部と電力変換部との間で授受されるエネルギーの変化の基準が片寄っている場合においてもエネルギーの授受の変化点を的確に捉えることができ、かつ、前記出力電圧の変動幅の監視し、この変動幅を制御に反映することにより結果として前記出力電圧の変動を小さくし、さらに、誘導電動機の運転周波数が所定の基底周波数を超えた領域においても昇圧チョッパ部の出力電圧を制御できるので、インバータ装置の出力範囲全域にわたって、より精度よく空気調和装置の圧縮機に発生する振動を軽減させることができる。また、前記昇圧チョッパ部の出力電圧は前記基底周波数以上の領域においてのみ、かつ必要なだけ上げるので、前記昇圧チョッパ部が備える平滑用コンデンサの寿命に影響を与えず、信頼性の高いものにできる。

【0012】請求項3に係わる本発明は、三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記パルスのパルス幅とタイミングとに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記交流の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する方向に補正しながら前記電力変換部を制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値に対しては前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧と現時点までに演算した最大回生電圧変動量との加算電圧に補正するようにした空気調和装置における振動軽減装置である。

【0013】本発明により、昇圧チョッパ部と電力変換部との間で授受されるエネルギーの変化の基準が片寄っている場合においてもエネルギーの授受の変化点を的確に捉えることができ、また、誘導電動機の運転周波数が所定の基底周波数を超えた領域においては昇圧チョッパ

部の出力電圧を最大回生電圧変動量だけ上げて制御することにより、昇圧チョッパ電圧制御部の制御を簡単にしながらインバータ装置の出力範囲全域にわたって安価に空気調和装置の圧縮機に発生する振動を軽減させることができる。また、前記昇圧チョッパ部の出力電圧は前記基底周波数以上の領域においてのみ、かつ必要なだけ上げるので、前記昇圧チョッパ部が備える平滑用コンデンサの寿命に影響を与えず、信頼性の高いものにできる。

【0014】請求項4に係わる本発明は、三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記昇圧チョッパ部の出力電圧を検出する直流電圧検出部と、前記検出した直流電圧の変動幅を検出する直流部電圧変動検出部と、前記直流電圧の変動幅を所定の直流部変動許容値と比較し、前記変動幅が前記直流部変動許容値を超えると超過分に対応した変動係数を出力する比較部と、前記パルスのパルス幅とタイミングと前記変動係数とに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記交流の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する方向に補正しながら前記電力変換部を制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値に対しては前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧と現時点までに演算した最大回生電圧変動量との加算電圧に補正するようにした空気調和装置における振動軽減装置である。

【0015】本発明により、昇圧チョッパ部と電力変換部との間で授受されるエネルギーの変化の基準が片寄っている場合においてもエネルギーの授受の変化点を的確に捉えることができ、かつ、前記出力電圧の変動幅を監視し、この変動幅を制御に反映することにより結果として前記出力電圧の変動を小さくし、さらに、誘導電動機の運転周波数が所定の基底周波数を超えた領域において

は昇圧チョッパ部の出力電圧を最大回生電圧変動量だけ上げて制御することにより、昇圧チョッパ電圧制御部の制御を簡単にしながらインバータ装置の出力範囲全域にわたって、より精度よく空気調和装置の圧縮機に発生する振動を軽減させることができる。また、前記昇圧チョッパ部の出力電圧は前記基底周波数以上の領域においてのみ、かつ必要なだけ上げるので、前記昇圧チョッパ部が備える平滑用コンデンサの寿命に影響を与えず、信頼性の高いものにできる。

10 【0016】

【発明の実施の形態】請求項1に係わる本発明において、昇圧チョッパ部は、整流部が出力する直流電圧を任意の直流電圧に変換して出力する手段を意味し、とくに、整流部が出力する直流電圧、すなわち整流電圧以上に昇圧して出力することも可能な点が特徴である。これにより、電力変換部に印加する直流電圧を前記整流電圧以上にまで補正することを可能にしている。電力変換部は直流電圧を周波数可変および電圧可変の交流電圧に変換して出力する手段を意味し、とくに構成を限定するものではないが、PWM制御により交流出力の周波数および電圧を可変制御できる手段とする。電圧変動検出部は、前記昇圧チョッパ部の出力と前記電力変換部との間で授受されるエネルギーの変化を電圧変動として検出する手段を意味し、実施例では、前記昇圧チョッパ部と前記電力変換部との間に挿入した固定抵抗器の両端の電圧により検出する。この電圧には、前記昇圧チョッパ部が前記電力変換部へ出力する平均電力に対応する平均電圧と、誘導電動機の回生状態と力行状態とに伴う電力変動に対応する電圧変動とを含む。

30 【0017】変動分検出部は、前記電圧変動のみを交流成分として抽出する手段を意味し、実施例では、前記電圧変動検出部の出力をコンデンサを介して取り出し、コンパレータにより前記平均電圧と比較整形して、電圧変動に対応するパルスを出力する手段とする。前記パルスの切り替わりは、回生状態と力行状態との切り替わりに対応し、パルス幅は回生状態と力行状態とが切り替わる変動の周波数に対応する。なお、タイミングは回生状態と力行状態のタイミングを意味する。

40 【0018】波形演算部は、本質的には前記電力変換部を制御する手段を意味するが、請求項1に係わる本発明においては、前記昇圧チョッパ部の出力電圧 V と、前記電力変換部の周波数 F とを制御し、 V/F の比を一定に保ちつつ、前記電圧変動に基づいて出力電圧 V と周波数 F とを、それぞれの本来の指令値である昇圧チョッパ基準電圧指令値と基本周波数指令値を補正することにより、誘導電動機の回生状態と力行状態とを抑制する方向に制御する。このとき、前記パルスのパルス幅から所定の関係により、前記基本周波数指令値を補正する回生周波数変動量と力行周波数変動量とを演算し、昇圧チョッパ部の出力電圧を補正する回生電圧変動量と力行電圧変

動量とは、それぞれ前記 V/F 比から前記回生周波数変動量と前記力行周波数変動量とに見合って演算する。

【0019】所定の基底周波数は、前記昇圧チョッパ部の出力電圧が前記整流電圧に等しいときに V/F 一定の関係から決まる周波数を意味する。したがって、補正した基本周波数指令値が前記基底周波数を超える場合には、前記昇圧チョッパ部の出力電圧を前記整流電圧より高く補正することになる。

【0020】請求項2に係わる本発明において、直流電圧検出部は、前記昇圧チョッパ部の出力電圧を検出する手段を意味し、構成については限定されるものではない。直流部電圧変動検出部は、前記直流電圧検出部で検出した直流電圧における変動幅を検出する手段を意味し、構成については限定されるものではない。比較部は、前記直流電圧の変動幅に対応して、所定の直流部変動許容値を超える超過分に対して所定の関係で与える変動係数を出力する手段を意味し、実施例では、前記直流部変動許容値を超える超過分に比例する変動係数を出力し、前記直流部変動許容値以下では1.0とするが、これに限定されるものではない。この変動係数は、昇圧チョッパ部の出力電圧の変動を前記回生電圧変動量および前記力行電圧変動量に反映するものであり、請求項1に係わる本発明における回生電圧変動量と力行電圧変動量のそれぞれに乗算し、昇圧チョッパ部の直流電圧の変動が前記直流部変動許容値より大きい場合に、変動幅の大きさに比例して補正を大きくすることにより、結果として昇圧チョッパ部の直流電圧の変動を抑制するフィードバックとして作用し、振動をより効果的に抑制することを目的としている。

【0021】請求項3および請求項4に係わる本発明において、波形演算部の制御は、請求項1および請求項2に係わる本発明とは異なり、前記周波数変動量に対応して行う直流電圧の補正と周波数の補正とをいずれも電力変換部のみで行い、昇圧チョッパ部の出力電圧は補正しないことを原則とし、ただし、補正した基本周波数指令値が前記基底周波数を超えた場合のみ、現時点までの最大回生電圧変動量を加算して上げるようにしている。他の構成は請求項1ないし請求項2と同じである。

【0022】以下、本発明の実施例について説明する。

【0023】

【実施例】（実施例1）以下、本発明の空気調和装置における振動軽減装置の実施例1について図面を参照しながら説明する。本実施例は請求項1に係わる。

【0024】図1は本実施例におけるインバータ装置の構成を示すブロック図である。図1において、1は三相交流電源、2は三相交流電源1に直列挿入されたリアクタ、3はインバータ装置、4は圧縮機を駆動する誘導電動機である。インバータ装置3において、5は三相交流を整流する整流部、6は整流部5が出力する直流電圧を昇圧する昇圧チョッパ部、7は整流部5と昇圧チョッパ

部6とで構成される直流電源部、8は直流電源部7が出力する直流電圧を周波数可変の交流電圧に変換する電力変換部、9は直流電源部7と電力変換部8との間の電圧変動を検出する電圧変動検出部、10は電圧変動検出部9で検出した電圧変動における変動分を検出する変動分検出部、11は基底周波数と基本周波数指令値と前記変動分とに対応して電力変換部8を制御する波形を演算する波形演算部、12は昇圧チョッパ基準電圧指令値と前記変動分とに対応して昇圧チョッパ部6を制御する昇圧チョッパ電圧制御部である。

【0025】図2は電圧変動検出部9の構成を示すブロック図である。図2に示したように、電圧変動検出部9は直流電源部7と電力変換部8との間に接続され、たとえば固定抵抗器9aなどにより電流の変化を電圧の変化に変換し、続いて増幅器9bにより増幅したのち、ローパスフィルタ9cを通して不要な周波数成分を除去することにより、電圧変動における変動分を検出している。

【0026】上記構成における動作について説明する。図3は、振動が発生している場合の電圧変動検出部9の動作を示す波形図である。図3において、図3(a)は固定抵抗器9aに発生する電圧を示し、図3(b)はローパスフィルタ9cの出力を示す。なお、図3(c)は変動分検出部10の出力を示す。図3(a)において、正の電圧はインバータ装置3が誘導電動機4に回されている状態である回生状態を示し、負の電圧はインバータ装置3が誘導電動機4を回し過ぎている状態である力行状態を示している。また、図3(b)の出力には、図3(a)に示した電圧変動が直流分に重畳した交流成分として得られている。この交流成分の振幅の中心は平均電力に対応する平均電圧である。この電圧変動検出部9の出力は変動分検出部10に入力される。

【0027】図4は変動分検出部10の構成を示すブロック図である。図4において、10aはコンデンサ、10bおよび10cは固定抵抗器、10dはコンパレータである。変動分検出部10では、電圧変動検出部9の出力からコンデンサ10aにより前記交流成分のみを抽出し、コンパレータ10dにより、図3(c)に示したように、パルス整形して波形演算部11に出力する。この構成により、電圧変動の基準が片寄っている場合においても、平均電圧に対する正確に変化点を捉えることが可能となる。この変化点は平均電力の変化点に対応する。変動分検出部10の出力は波形演算部11に入力される。

【0028】以下、波形演算部11の動作について図面を参照しながら説明する。図5は波形演算部11の動作を示すフローチャートである。

【0029】まず、ステップ1において、変動分検出部10からの入力パルスのエッジ間測定が終了しているか否かを確認する。測定が完了していない場合はステップ5に移行するが、ステップ1で測定が完了している場合

はステップ2に移行して現在の波形演算部11の入力を確認する。ここで、波形演算部11の入力はパルスであるため、現時点がHiである場合、それ以前に測定が完了しているのであるから、そのエッジ間測定の対象はLowレベルの区間となる。同様に、波形演算部11の入力が現時点でLowであれば、それ以前に測定が完了しているのであるから、そのエッジ間測定の対象はHiレベルの区間となる。

【0030】入力パルスがHiであった場合は、ステップ3に移行して、その測定結果を回生時データとして格納し、図6の關係に従って回生時の周波数変動量を演算してステップ5に移行する。また、入力パルスがLowであった場合は、ステップ4に移行して、測定結果を力行時データとして格納し、同様に、図6の關係に従って、測定されたパルス幅から力行時の周波数変動量を演算してステップ5に移行する。ステップ5では、現在の入力パルスの状態を監視し、立ち下がりエッジを検出する。これにより、力行状態と回生状態との変化点を検出する。

【0031】ステップ5において、立ち下がりエッジを検出した場合には、ステップ6に移行し、次式に従って基本周波数指令値を変更する。

基本周波数指令値 ← 基本周波数指令値 + 回生周波数変動量

つぎに、ステップ7に移行して基本周波数指令値と基底周波数とを比較し、基本周波数指令値が基底周波数未満の場合はステップ8に移行する。ステップ8では、昇圧チョッパによる振動軽減制御は必要ないので、次式の演算を行い、処理を終了する。

回生電圧変動量 = 0

また、ステップ7で、基本周波数指令値が基底周波数以上である場合はステップ9へ移行し、次式に従って昇圧チョッパ電圧制御部12へ出力する回生電圧変動量を演算する。

回生電圧変動量 = 回生周波数変動量 × 単位変化電圧

ここで、単位変化電圧とは、基本周波数の、たとえば1Hz当りの電圧値であり、V/Fの傾きに相当する量である。

【0032】また、ステップ5で立ち下がりエッジが検出できていない場合には、ステップ10に移行して立ち上がりエッジを検出する。立ち上がりエッジを検出した場合には、ステップ11に移行して次式に従って基本周波数指令値を変更する。基本周波数指令値 ← 基本周波数指令値 - 力行周波数変動量

ここで、立ち上がりエッジも検出できなかった場合には終了するが、検出した場合にはステップ12に移行し、基本周波数指令値を基底周波数と比較し、基本周波数指令値が基底周波数未満の場合はステップ14に移行する。

【0033】ステップ14では、昇圧チョッパによる振動軽減制御は必要ないので、次式の演算を行い、処理を

終了する。

力行電圧変動量 = 0

また、ステップ12で基本周波数指令値が基底周波数以上である場合はステップ13へ移行し、次式に従って昇圧チョッパ電圧制御部12へ出力する力行電圧変動量を演算する。

力行電圧変動量 = 力行周波数変動量 × 単位変化電圧

以上の処理により、波形演算部11は回生電圧変動量および力行電圧変動量を演算する。なお、基本周波数指令値が決定してからPWM信号を出力するまでのプロセスは、一般的な内容であるので説明を省略する。また、現在の周波数から、新たに演算をし直した基本周波数指令値への変化については、所定のレートにより滑らかに加減速する。

【0034】つぎに、昇圧チョッパ電圧制御部12について説明する。昇圧チョッパ電圧制御部12は、波形演算部11により演算された回生電圧変動量または力行電圧変動量を昇圧チョッパ基準電圧指令値に加減して目標電圧を決定する。図7は本実施例における昇圧チョッパ部6の動作を示すフローチャートである。以下に示すように、昇圧チョッパ部6の出力電圧を前記目標電圧に応じて滑らかに変化させる。

【0035】まず、ステップ1において、力行制御のタイミングであるか否かを確認する。力行制御のタイミングである場合はステップ2へ移行し、力行制御のタイミングでない場合はステップ4へ移行する。ステップ2では、力行制御時の目標電圧に現在の出力電圧が到達しているか否かを確認する。到達している場合は処理を終了し、到達していない場合にはステップ3へ移行する。ステップ3では出力電圧を次式に従って更新し、そののち処理を終了する。

昇圧出力電圧 = 昇圧チョッパ基準電圧指令値 - 単位変化電圧

また、力行制御のタイミングでない場合にはステップ4に移行する。ステップ4では、現在の出力電圧が回生状態における目標電圧に到達しているか否かを確認する。到達している場合は、処理を終了し、到達していない場合はステップ5へ移行する。ステップ5では、出力電圧の更新を次式に従って行ったのち、処理を終了する。

昇圧出力電圧 = 昇圧チョッパ基準電圧指令値 + 単位変化電圧

以上の処理を繰り返すことにより、回生時にはインバータ装置3が誘導電動機4に回されている状態であるため、それを打ち消すようにインバータ装置3の出力周波数と出力電圧とを上げ、また力行時には、インバータ装置3が誘導電動機4を回し過ぎている状態であるため、それを打ち消すようにインバータ装置3の出力周波数と出力電圧とを下げることにより、昇圧チョッパ部6と電力変換部8のエネルギーの変動は抑制され、インバータ装置3の運転周波数全域にわたって安定した状態となる

とともに、圧縮機に発生する振動を軽減することができる。

【0036】以上のように本実施例によれば、直流電源部7と電力変換部8との間の電圧変動における変動分を交流成分として抽出することにより、電圧変動が回生または力行のいずれかに片寄っていても変化点を的確に検出でき、また、前記交流成分の波形を整形したパルスのパルス幅に基づいて、基本周波数と昇圧チョッパの出力電圧とを、回生時と力行時それぞれにおいて誘導電動機4の回転を打ち消す方向に、補正しながら制御することにより、圧縮機に発生する振動を安定に軽減でき、かつ上記の動作は基底周波数以上まで可能であるため、運転周波数の全域にわたって振動を軽減することができる。

【0037】（実施例2）以下、本発明の空気調和装置の振動軽減装置の実施例2について図面を参照しながら説明する。本実施例は請求項2に係わる。

【0038】図8は本実施例におけるインバータ装置3の構成を示すブロック図である。なお、図1と同じ構成要素には同一番号を付与して詳細な説明を省略する。図8において、13は直流電源部7が出力する直流電圧を検出する直流電圧検出部、14は前記直流電圧における変動を検出する直流部電圧変動検出部、15は直流電圧における変動を直流部変動許容値と比較する比較部である。

【0039】本実施例が実施例1と異なる点は、波形演算部11は、直流電源部7が出力する直流電圧の変動分を加味して回生電圧変動量および力行電圧変動量を算出するようにしたことにある。他の動作については実施例1と同様である。

【0040】上記構成における動作について図面を参照しながら説明する。図9は本実施例における波形演算部11の動作を示すフローチャートである。なお、実施例1の図5に示したフローチャートにおいてステップ7の判定結果がYESの場合、およびステップ12の判定結果がYESの場合を除いては同じ処理であるので、これらについての説明を省略する。

【0041】ステップ7で基本周波数指令値が基底周波数以上である場合、ステップ9へ移行する。ステップ9では、次式に従って昇圧チョッパ電圧制御部12へ出力する回生電圧変動量を演算する。

回生電圧変動量＝変動係数×回生周波数変動量×単位変化電圧

ここで、変動係数とは、振動軽減制御をかけている最中の直流電圧の変動幅が直流部変動許容値を超えているときの程度を示し、直流電圧の変動幅と変動係数との関係を図10に示す。

【0042】また、ステップ12で、基本周波数指令値が基底周波数以上である場合はステップ13へ進む。ステップ13では、次式に従って昇圧チョッパ電圧制御部12へ出力する力行電圧変動量を演算する。

力行電圧変動量＝変動係数×力行周波数変動量×単位変化電圧

以上の処理により、波形演算部11は、回生電圧変動量と回生電圧変動量とを算出する。なお、基本周波数指令値が決定してからPWM信号を出力するまでのプロセスは、一般的な内容であるので、説明を省略する。また、現在の周波数から、新たに演算をし直した基本周波数指令値への変化については、所定のレートにより滑らかに加減速する。

10 【0043】つぎに、直流電圧検出部13ないし比較部15の動作について説明する。直流部電圧変動検出部14では、直流電圧検出部13の出力から、最大電圧および最小電圧を検出し、その値から直流電圧の変動幅を演算して比較部15に出力する。比較部15では、前記直流電圧の変動幅を所定の直流部変動許容値と比較し、直流電圧の変動幅が直流部変動許容値を超えている場合は、図10の関係に従って変動係数を波形演算部11へ出力する。直流電圧の変動幅が直流部変動許容値以下の場合は、変動係数を1として波形演算部11へ出力する。

20 【0044】以上の処理を繰り返すことにより、回生時にはインバータ装置3が誘導電動機4に回されている状態であるため、それを打ち消すようにインバータ装置3の出力周波数と出力電圧とを上げ、また力行時には、インバータ装置3が誘導電動機4を回し過ぎている状態であるため、それを打ち消すようにインバータ装置3の出力周波数と出力電圧とを下げることにより、昇圧チョッパ部6と電力変換部8のエネルギーの変動は抑制され、インバータ装置3の運転周波数全域にわたり安定した状態となるとともに、圧縮機に発生する振動を軽減することができる。

30 【0045】さらに、直流電圧検出部13により直流電圧の変動をフィードバックすることにより、振動軽減制御に用いる電圧の変動幅を、振動が収束するように修正することで、さらに精度の高い振動軽減制御が行えることとなる。

40 【0046】以上のように本実施例によれば、直流電源部7の出力直流電圧の変動幅に基づいて回生電圧変動量および力行電圧変動量を大きくして制御することにより、実施例1の構成よりも、さらに高精度に振動を軽減することができる。

【0047】（実施例3）以下、本発明の空気調和装置における振動軽減装置の実施例3について図面を参照しながら説明する。

【0048】図11は本実施例におけるインバータ装置3の構成を示すブロック図である。本実施例の構成をブロック図で示すと実施例1と同じである。

50 【0049】本実施例が実施例1と異なる点は、電圧変動に対応して補正した基本周波数指令値が基底周波数を超えた場合は、昇圧チョッパ部6の昇圧出力電圧を現時

点までの最大回生電圧変動量だけ固定して上げ、波形演算部11の処理によりインバータ装置3の周波数と出力電圧とを変えて誘導電動機4の振動を低減するようにしたことにある。したがって、昇圧チョッパ電圧制御部12の処理が簡素化される。

【0050】上記構成における動作について図面を参照しながら説明する。図12は本実施例における波形演算部11の動作を示すフローチャートである。なお、図12において、変動分検出部10までの処理に関しては実施例1と同様であり、説明を省略する。また、ステップ8、ステップ9およびステップ13、ステップ14までの処理に関しても実施例1と同様であり、説明を省略する。

【0051】ステップ15では、ステップ9において毎回演算している回生電圧変動量の最大値を判断している。今回演算した回生電圧変動量を前回までの最大回生電圧変動量と比較し、回生電圧変動量が最大回生電圧変動量以上である場合には、ステップ16へ移行して最大回生電圧変動量を更新し、ステップ17へ移行する。また、回生電圧変動量が最大回生電圧変動量未満の場合にはステップ17へ移行する。ステップ17では、位相更新処理および出力電圧データの獲得を行い、ステップ18へ移行する。このステップ17における処理に関しては、PWM波形により制御するインバータ装置において一般的な処理であるので、説明を省略する。

【0052】ステップ18では、昇圧チョッパ部6により増加する直流電圧を次式に従って補正し、ステップ19へ移行する。

昇圧出力電圧=昇圧チョッパ基準電圧指令値+最大回生電圧変動量

ステップ19では、現在の周波数が基本周波数指令値に到達しているか否かを確認する。到達している場合は処理を終了し、到達していない場合にはステップ20に移行する。ステップ20では、次式に従って、出力電圧の変更を行い、処理を終了する。

出力電圧 ← 出力電圧-単位変化電圧

つぎに、力行時の処理について説明する。ステップ21では回生時と同様に、位相更新処理および出力電圧データの獲得を行い、ステップ22へ移行する。ステップ22では、回生時と同様に、昇圧チョッパ部6により増加する直流電圧を次式に従って補正し、ステップ23へ移行する。

昇圧出力電圧=昇圧チョッパ基準電圧指令値+最大回生電圧変動量

力行時においても最大回生電圧変動量を用いるのは、目安として補正しているためである。

【0053】ステップ23では、現在の周波数が基本周波数指令値に到達しているか否かを確認する。到達している場合は処理を終了し、到達していない場合はステップ24に移行する。ステップ24では、次式に従って出

力電圧の変更を行い、処理を終了する。

出力電圧 ← 出力電圧+単位変化電圧

つぎに、図12に示す昇圧チョッパ電圧制御部12について説明する。図13は、昇圧チョッパ電圧制御部12の動作を示すフローチャートである。ステップ1において、現在、振動軽減制御を行っているか否かを判定する。振動軽減制御中である場合にはステップ2へ進み、振動軽減制御中でない場合は、ステップ3へ移行する。ステップ2では昇圧チョッパ部6の出力電圧を変更するために次式に従って昇圧チョッパ基準電圧指令値を変更し、作業を終了する。

昇圧チョッパ基準電圧指令値 ← 昇圧チョッパ基準電圧指令値+最大回生電圧変動量

ステップ1において振動が発生していないと判断した場合にはステップ3へ移行する。ステップ3では、振動が発生していないため、昇圧チョッパ基準電圧指令値を元の昇圧チョッパ基準電圧指令値に戻し、処理を終了する。また、昇圧チョッパ電圧制御部12により昇圧チョッパ部6を駆動するパルスを生成する過程については、一般的な処理内容であるので、説明を省略する。

【0054】以上の処理を繰り返すことにより、必要最小限の直流電源部7の電圧増加により、インバータ装置3の運転周波数全域において、回生時にはインバータ装置3が誘導電動機4に回されている状態であるため、それを打ち消すようにインバータ装置3の出力周波数および出力電圧を上げ、また力行時には、インバータ装置3が誘導電動機4を回し過ぎている状態であるため、それを打ち消すようにインバータ装置3の出力周波数および出力電圧を下げることにより、昇圧チョッパ部6と電力変換部8のエネルギーの変動は抑制され、安定した状態となるとともに、圧縮機に発生する振動を軽減することができる。

【0055】また、昇圧チョッパ部6では振動軽減制御で必要最小限な電圧を上げてしまい、振動を軽減するための細密な制御は波形演算部11が受け持ったため、昇圧チョッパ部6の制御を簡単にすることができる。

【0056】以上のように本実施例によれば、回生電圧変動量の最大回生電圧変動量を常に更新し、直流電源部7と電力変換部8との間の電圧変動に対応して変更した基本周波数指令値が基底周波数を超える場合には昇圧チョッパ部6の昇圧出力電圧を前記最大回生電圧変動量で補正し、その昇圧出力電圧のもとにインバータ装置3の周波数と出力電圧とを変えて誘導電動機4の回生状態または力行状態を打ち消す方向に制御することにより、圧縮機に発生する振動を軽減するとともに、昇圧チョッパ部6の処理を簡単にすることができる。

【0057】(実施例4)以下、本発明の空気調和装置における振動軽減装置の実施例4について図面を参照しながら説明する。本実施例は請求項4に係わる。

【0058】図14は本実施例におけるインバータ装置

3の構成を示すブロック図である。なお、本実施例の構成をブロック図で示すと、実施例3の図8と同じになり、同じ構成要素には同一番号を付与して詳細な説明を省略する。本実施例が実施例3と異なる点は、波形演算部11の制御において、実施例2と同様に、昇圧チョッパ部6の直流電圧の変動幅に対応する変動係数を加味したことがある。

【0059】上記構成における動作について図面を参照しながら説明する。図15は本実施例における波形演算部11の動作を説明するフローチャートである。なお、図15において、変動分検出部10までの処理に関しては実施例1と同様であり、説明を省略する。また、ステップ9およびステップ13を除いては実施例3と同様であり、説明を省略する。

【0060】ステップ9では、回生電圧変動量を次式に従って演算する。

回生電圧変動量＝変動係数×回生周波数変動量×単位変化電圧

また、ステップ13では、力行電圧変動量を次式に従って演算する。

力行電圧変動量＝変動係数×力行周波数変動量×単位変化電圧

なお、前記変動係数は、実施例3における変動係数と同じである。また、昇圧チョッパ電圧制御部12に関しては、実施例3で説明したものと同様の内容であるため説明を省略する。また、直流電圧検出部13の直流電圧検出から比較部15における変動係数の演算までの過程は実施例2と同様である。すなわち、本実施例は、実施例3に対し電圧フィードバックを付加することにより振動に対する制御精度を向上させたものである。

【0061】以上の処理を繰り返すことにより、必要最小限の直流電源部の電圧増加によりインバータ装置3の運転周波数全域において、回生時にはインバータ装置3が誘導電動機4に回されている状態であるため、それを打ち消すようにインバータ装置3の周波数と出力電圧とを上げ、また力行時には、インバータ装置3が誘導電動機4を回し過ぎている状態であるため、それを打ち消すようにインバータ装置3の周波数と出力電圧とを下げることで、昇圧チョッパ部6と電力変換部8のエネルギーの変動は抑制され安定した状態となるとともに、圧縮機に発生する振動を軽減することができる。

【0062】また、補正した基本周波数指令値が基底周波数を超える場合のみ、実施例3と同様に、昇圧チョッパ部6の昇圧出力電圧を最小限必要な最大回生電圧変動量だけ上げ、振動を軽減するための細密な制御は波形演算部11が受け持つため、昇圧チョッパ電圧制御部12の処理を簡単にすることができる。

【0063】さらに、実施例2と同様に、昇圧チョッパ部6が出力する直流電圧の変動をフィードバックすることにより、さらに精度の高い振動軽減制御を行えること

となる。

【0064】以上のように本実施例によれば、直流電源部7と電力変換部8との間の電圧変動と直流電源部7の直流電圧の変動とに基づいて回生電圧変動量と力行電圧変動量とを演算し、それらに基づいて補正した基本周波数指令値が基底周波数を超える場合には現時点までの最大回生電圧変動量により昇圧チョッパ部の昇圧出力電圧を固定して上げ、その昇圧出力電圧のもとに周波数と出力電圧とを、誘導電動機の回生状態と力行状態をそれぞれ打ち消す方向に制御することにより、誘導電動機の振動をより効果的に低減しながら、昇圧チョッパ電圧制御部の処理を簡略化することができる。

【0065】

【発明の効果】請求項1に係わる本発明は、三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記パルスのパルス幅とタイミングとに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記昇圧チョッパ部の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する方向に補正しながら前記電力変換部と前記昇圧チョッパ電圧制御部とを制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値に対応して前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧以上の範囲まで補正するようにした空気調和装置における振動軽減装置とすることにより、直流電源部と電力変換部との間で授受するエネルギーの変動を、極性により判定するのではなく、全体としての変動を見い出して制御するため、基準が片寄っている場合においても、エネルギーの変動を的確に捉え、かつ固定抵抗器を検出器に用いることで安価となるとともに、誘導電動機の運転周波数が基底周波数を超えた領域においても昇圧チョッパ部を制御することにより振動軽減制御を行うことができ、空気調和装置の圧縮機に発生

する振動を軽減させ、さらに、基底周波数以上の領域においては必要なときのみ必要量だけ直流電源部の電圧を上げるので、平滑用コンデンサの寿命に影響を与えず、信頼性の高いものにすることができる。

【0066】請求項2に係わる本発明は、三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記昇圧チョッパ部の出力電圧を検出する直流電圧検出部と、前記検出した直流電圧の変動幅を検出する直流部電圧変動検出部と、前記直流電圧の変動幅を所定の直流部変動許容値と比較し、前記変動幅が前記直流部変動許容値を超えると超過分に対応した変動係数を出力する比較部と、前記パルスのパルス幅とタイミングと前記変動係数とに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記昇圧チョッパ部の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する方向に補正しながら前記電力変換部と前記昇圧チョッパ電圧制御部とを制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値には前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧以上まで補正するようにした空気調和装置における振動軽減装置とすることにより、昇圧チョッパ部と電力変換部との間で授受されるエネルギーの変化の基準が片寄っている場合においてもエネルギーの授受の変化点を的確に捉えることができ、かつ、前記出力電圧の変動幅の監視し、この変動幅を制御に反映することにより結果として前記出力電圧の変動を小さくし、さらに、誘導電動機の運転周波数が所定の基底周波数を超えた領域においても昇圧チョッパ部の出力電圧を制御できるので、インバータ装置の出力範囲全域にわたって、より精度よく空気調和装置の圧縮機に発生する振動を軽減させることができる。また、前記昇圧チョッパ部の出力電圧は前記基底周波数以上の領域においてのみ、かつ必要なだけ上げるので、前記昇圧

チョッパ部が備える平滑用コンデンサの寿命に影響を与えず、信頼性の高いものにできる。

【0067】請求項3に係わる本発明は、三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記パルスのパルス幅とタイミングとに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記交流の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰り返しによる振動を軽減する方向に補正しながら前記電力変換部を制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値に対しては前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧と現時点までに演算した最大回生電圧変動量との加算電圧に補正するようにした空気調和装置における振動軽減装置とすることにより、昇圧チョッパ部と電力変換部との間で授受されるエネルギーの変化の基準が片寄っている場合においてもエネルギーの授受の変化点を的確に捉えることができ、また、誘導電動機の運転周波数が所定の基底周波数を超えた領域においては昇圧チョッパ部の出力電圧を最大回生電圧変動量だけ上げて制御することにより、昇圧チョッパ電圧制御部の制御を簡単にしながらインバータ装置の出力範囲全域にわたって安価に空気調和装置の圧縮機に発生する振動を軽減させることができる。また、前記昇圧チョッパ部の出力電圧は前記基底周波数以上の領域においてのみ、かつ必要なだけ上げるので、前記昇圧チョッパ部が備える平滑用コンデンサの寿命に影響を与えず、信頼性の高いものにできる。

【0068】請求項4に係わる本発明は、三相交流電源からリアクタを介して交流電力を入力し、周波数可変および電圧可変の交流電力を誘導電動機に供給するインバータ装置を備えた空気調和装置において、前記インバータ装置は、前記三相交流電源の交流電圧を整流する整流部と、前記整流部が出力する直流電圧を任意の直流電圧

に変換して出力する昇圧チョッパ部と、前記昇圧チョッパ部が出力する直流電圧を周波数可変および電圧可変の交流電圧に変換する電力変換部と、前記昇圧チョッパ部と前記電力変換部との間で授受されるエネルギーの変化を電圧変化として検出する電圧変動検出部と、前記電圧変動検出部の出力における交流成分のみを抽出し、平均電圧に比較して大きい部分と小さい部分とに対応したパルスを出力する変動分検出部と、前記昇圧チョッパ部の出力電圧を制御する昇圧チョッパ電圧制御部と、前記昇圧チョッパ部の出力電圧を検出する直流電圧検出部と、前記検出した直流電圧の変動幅を検出する直流部電圧変動検出部と、前記直流電圧の変動幅を所定の直流部変動許容値と比較し、前記変動幅が前記直流部変動許容値を超えると超過分に対応した変動係数を出力する比較部と、前記パルスのパルス幅とタイミングと前記変動係数とに基づいて前記誘導電動機の回生状態に対応する回生電圧変動量と力行状態に対応する力行電圧変動量とを演算し、前記電力変換部が出力する交流の周波数を指示する基本周波数指令値と前記交流の出力電圧とを、前記回生状態には前記回生電圧変動量、前記力行状態には前記力行電圧変動量に基づいて、前記誘導電動機の回生状態と力行状態との繰返しによる振動を軽減する方向に補正しながら前記電力変換部を制御する波形演算部とを備え、前記波形演算部は、前記補正において、所定の基底周波数を超える補正後の前記基本周波数指令値に対しては前記昇圧チョッパ部の出力電圧を前記整流部の出力電圧と現時点までに演算した最大回生電圧変動量との加算電圧に補正するようにした空気調和装置における振動軽減装置とすることにより、昇圧チョッパ部と電力変換部との間で授受されるエネルギーの変化の基準が片寄っている場合においてもエネルギーの授受の変化点を的確に捉えることができ、かつ、前記出力電圧の変動幅の監視し、この変動幅を制御に反映することにより結果として前記出力電圧の変動を小さくし、さらに、誘導電動機の運転周波数が所定の基底周波数を超えた領域においては昇圧チョッパ部の出力電圧を最大回生電圧変動量だけ上げて制御することにより、昇圧チョッパ電圧制御部の制御を簡単にしながらインバータ装置の出力範囲全域にわたって、より精度よく空気調和装置の圧縮機に発生する振動を軽減させることができる。また、前記昇圧チョッパ部の出力電圧は前記基底周波数以上の領域においてのみ、かつ必要なだけ上げるので、前記昇圧チョッパ部が備える平滑用コンデンサの寿命に影響を与えず、信頼性の高いものにできる。

【図面の簡単な説明】

【図1】本発明の実施例1におけるインバータ装置の構成を示すブロック図

【図2】同実施例における電圧変動検出部の構成を示すブロック図

【図3】同実施例における電圧変動検出部の動作を示す

波形図

【図4】同実施例における変動分検出部の構成を示すブロック図

【図5】同実施例における波形演算部の動作を示すフローチャート

【図6】同実施例における入力パルスのパルス幅と周波数変動量との関係を示す特性図

【図7】同実施例における昇圧チョッパ電圧制御部の動作を示すフローチャート

10 【図8】本発明の実施例2におけるインバータ装置の構成を示すブロック図

【図9】同実施例におけるインバータ装置の動作を示すフローチャート

【図10】同実施例における直流電圧の変動幅と変動係数との関係を示す特性図

【図11】本発明の実施例3におけるインバータ装置の構成を示すブロック図

【図12】同実施例における波形演算部の動作を示すフローチャート

20 【図13】同実施例における昇圧チョッパ電圧制御部の動作を示すフローチャート

【図14】本発明の実施例4におけるインバータ装置の構成を示すブロック図

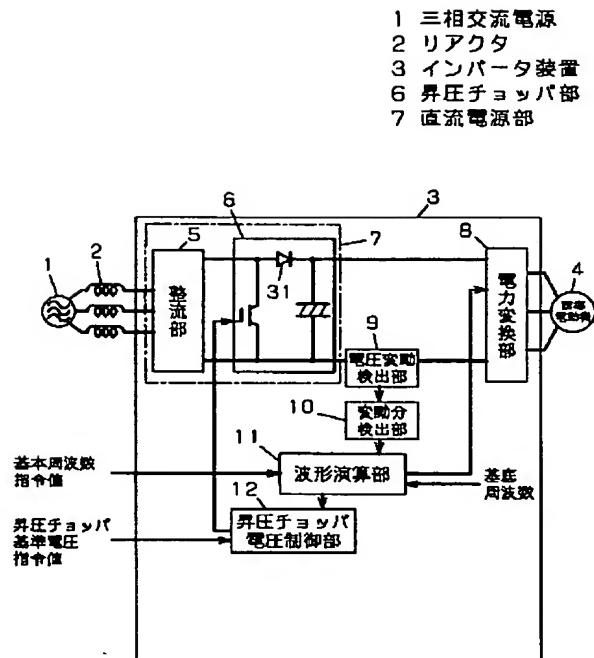
【図15】同実施例における波形演算部の動作を示すフローチャート

【図16】従来例における振動時に直流電源部と電力変換部との間に流れる電流を示す波形図

【符号の説明】

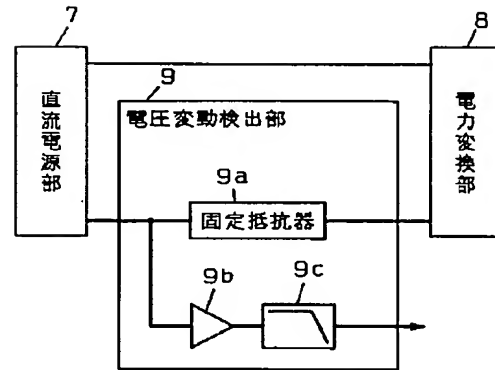
- 1 三相交流電源
- 2 リアクタ
- 3 インバータ装置
- 4 誘導電動機
- 5 整流部
- 6 昇圧チョッパ部
- 7 直流電源部
- 8 電力変換部
- 9 電圧変動検出部
- 9 a 固定抵抗器
- 9 b 増幅器
- 9 c ローパスフィルタ
- 10 変動分検出部
- 10 a コンデンサ
- 10 b, 10 c 固定抵抗器
- 10 d コンパレータ
- 11 波形演算部
- 12 昇圧チョッパ電圧制御部
- 13 直流電圧検出部
- 14 直流部電圧変動検出部
- 15 比較部

【図1】

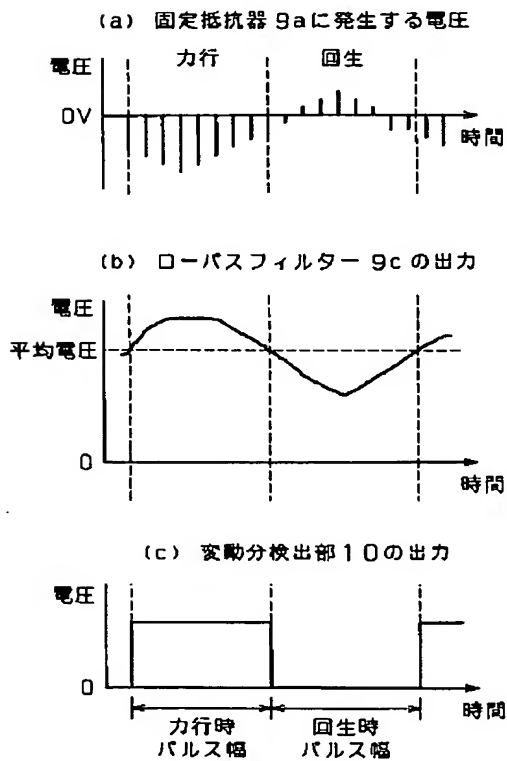


【図2】

9b 増幅器
9c ローパスフィルタ

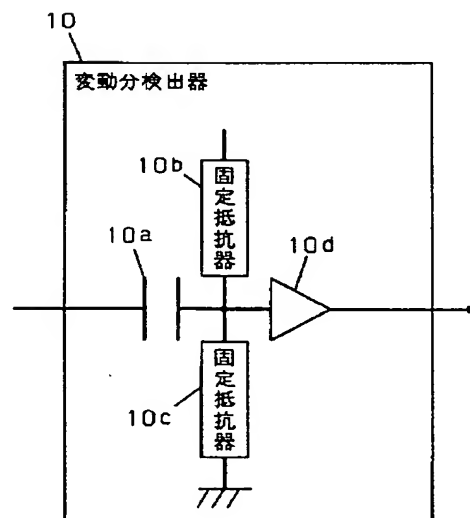


【図3】

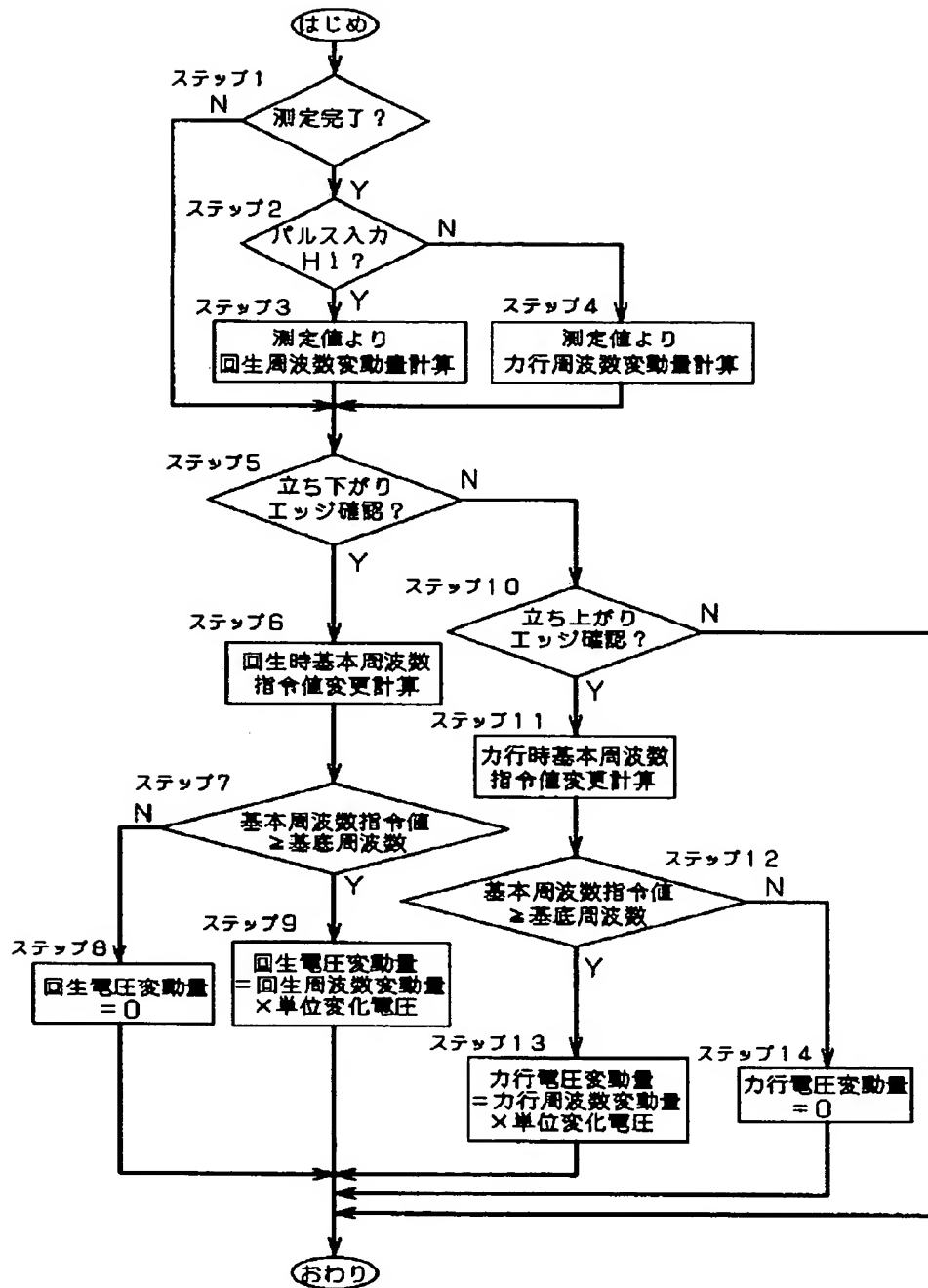


【図4】

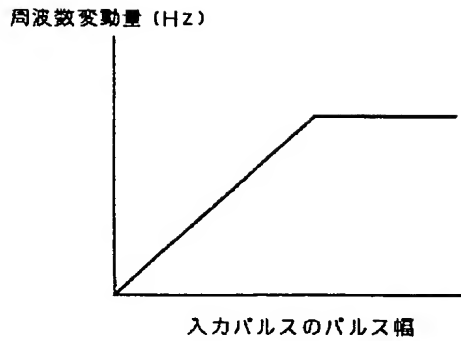
10a コンデンサ
10d コンパレータ



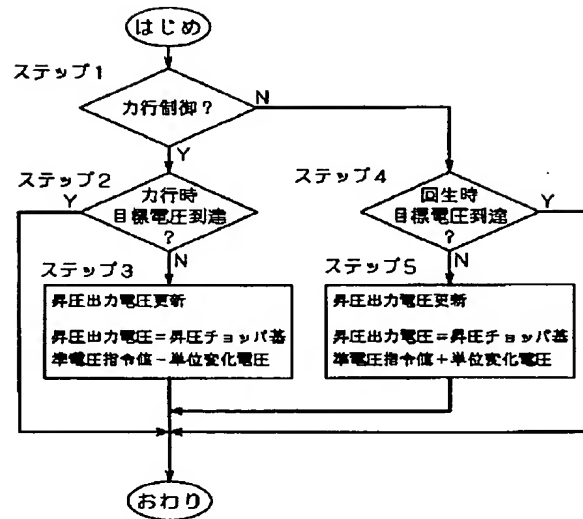
【図5】



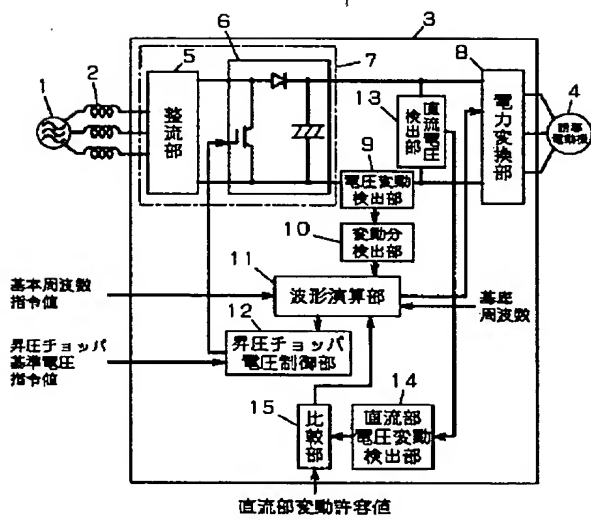
【図6】



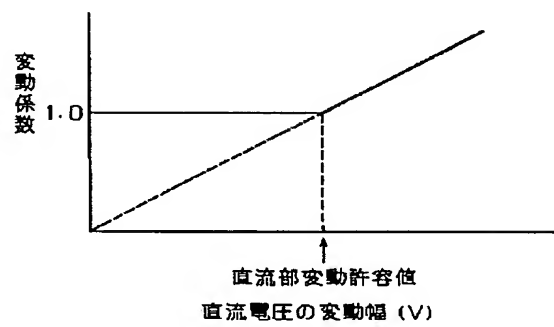
【図7】



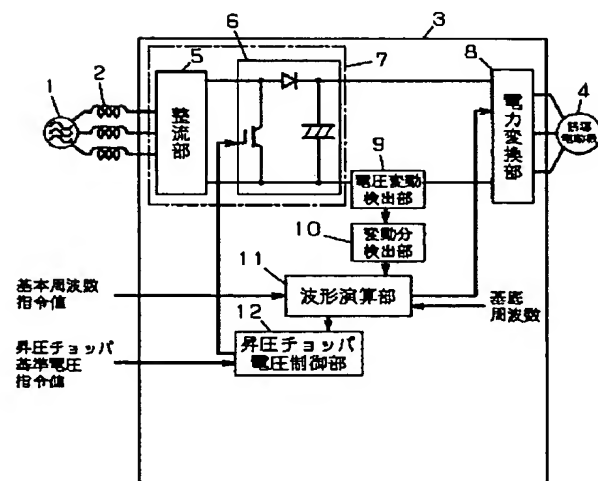
【図8】



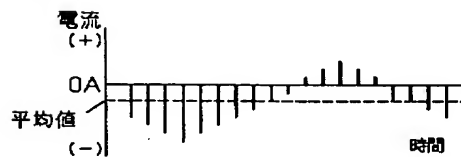
【図10】



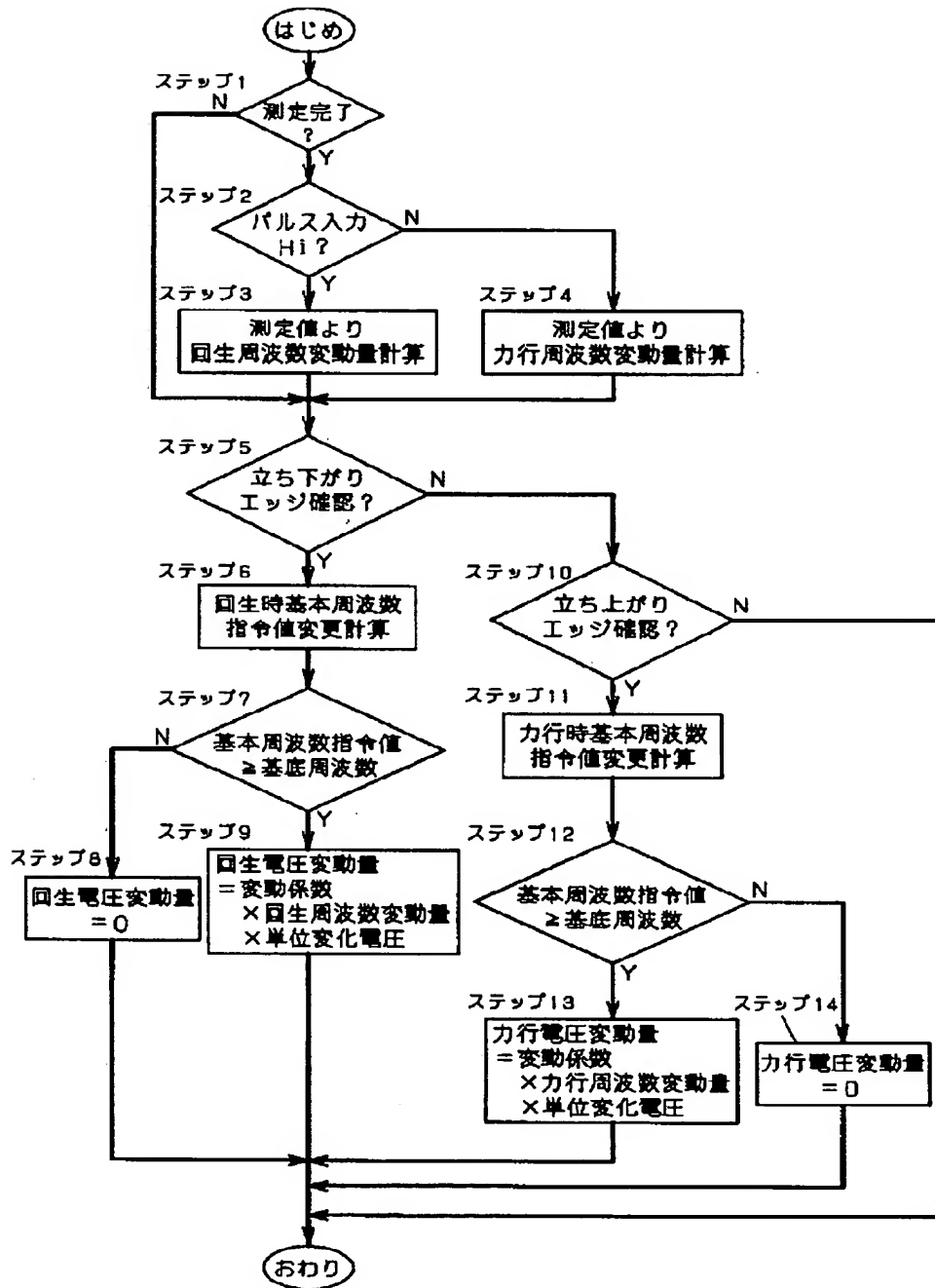
【図11】



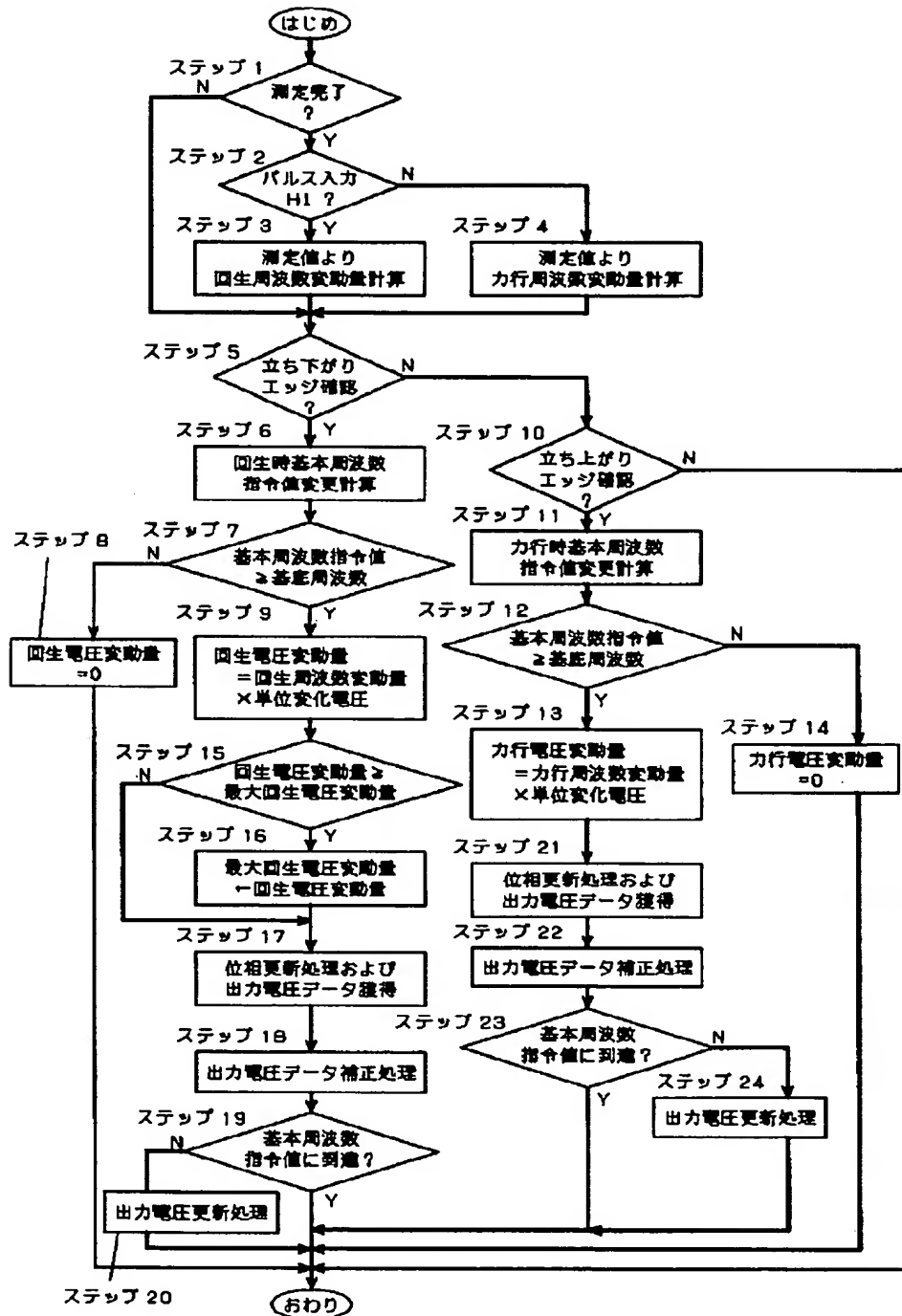
【図16】



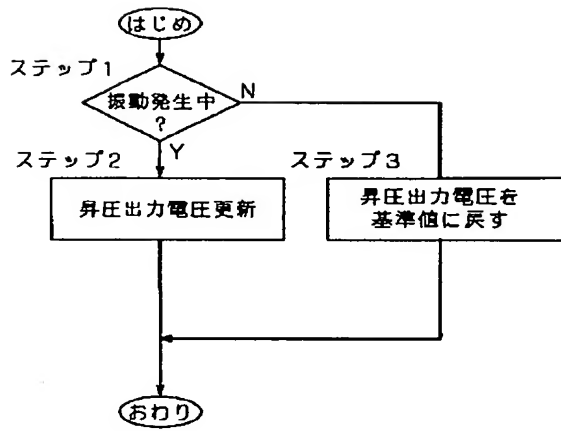
【図9】



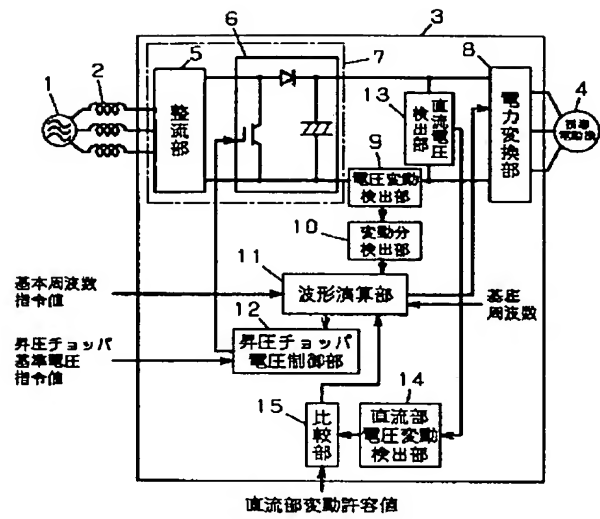
【図12】



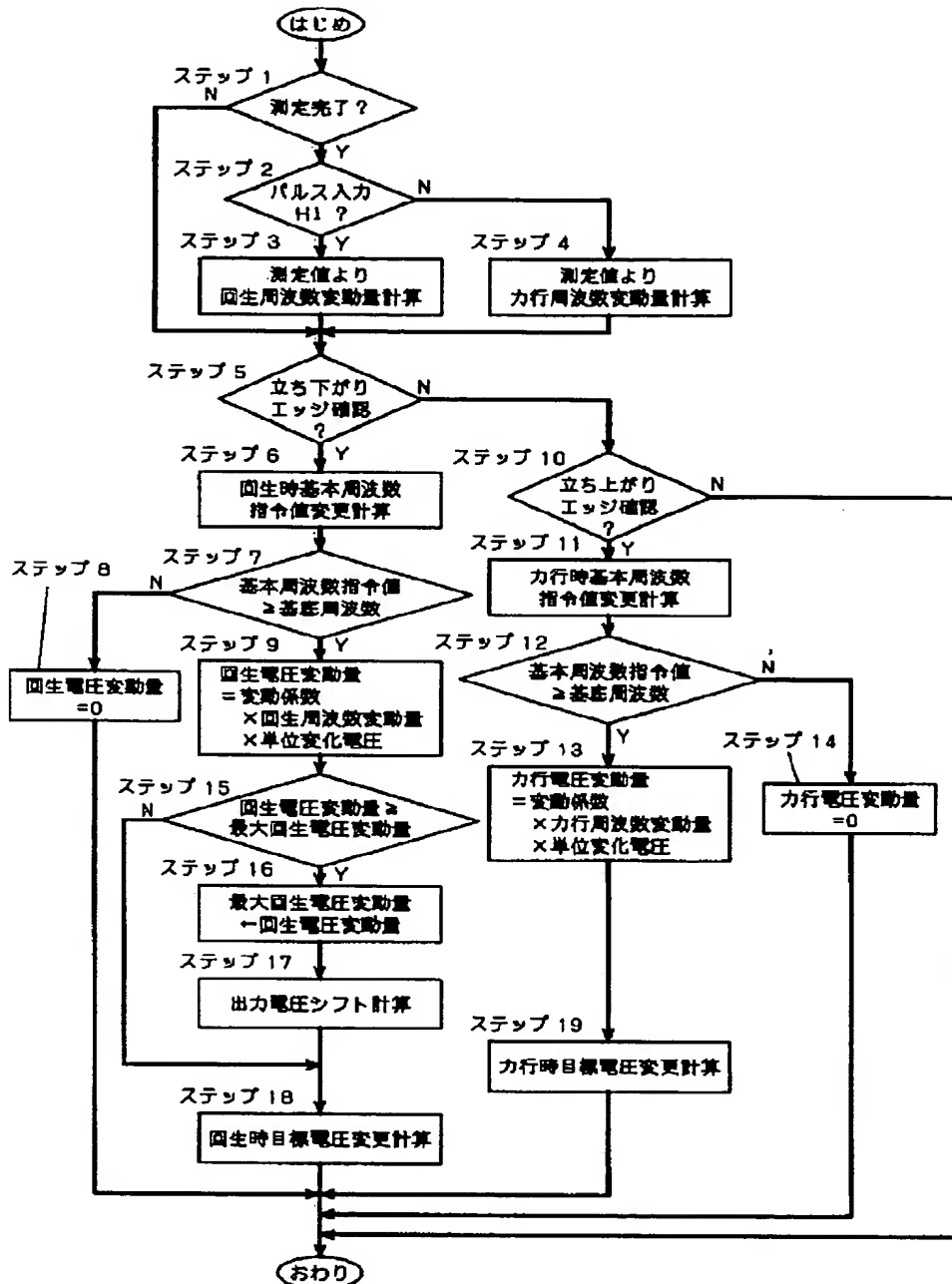
【図13】



【図14】



【図15】



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